

IMPO Regional Data RoadMAP

Prepared for the
Indianapolis Metropolitan Planning Organization



Prepared by



In association with



Caliper[®]
| | | | | | | | | |

Transportation & Mapping Solutions
Maptitude • TransCAD • TransModeler



This document was prepared with funding in part from the State of Indiana, the Indiana Department of Transportation, and the Federal Highway Administration. This financial assistance notwithstanding, the contents of this document do not necessarily reflect the official view or policies of the funding agencies.



Table of Contents

TABLE OF CONTENTS.....	III
INTRODUCTION.....	5
TRADITIONAL/CORE DATA RECOMMENDATIONS.....	6
OD & ADT Data	6
Travel Time Data	8
Employment Data	9
Safety Data	10
Travel Survey Data	10
Transportation Improvement Plan Data	12
RECOMMENDED ANALYTICAL STUDIES.....	12
Safety Studies	12
Strategic Modeling	13
Before & After Studies	13
RECOMMENDED ITDM IMPROVEMENTS	14
Master Network	14
Speed Calibration	14
Population Synthesis	15
Disaggregate Trip Generation	16
Market Segment Tracking	17
Work-from-Home Module	18
E-commerce Module	18
Dynamic Segmentation	18
Destination Choice Improvements	20
Mode Choice Improvements	20
Freight Model Update	22
OTHER RECOMMENDED TOOLS.....	23
CommunityViz and Ancillary Tools	23



Benefit-Cost Calculator 24

Accessibility Tool..... 27

Map Sharing Online 29

Socioeconomics Post-Processor 29

RECOMMENDATIONS FOR NEW IMPO INITIATIVES31

Revisiting Prior Findings and Recommendations..... 31

Staff Capacity: A Key Contextual Consideration 32

An Overview of Process and Organization of this Memo 33

Cross-Cutting Resources..... 34

Housing..... 37

Economic Development 41

Resiliency 43

Other 45

Summary..... 45

RECOMMENDED DATA, MODELING, AND ANALYSIS BUDGET47

OTHER POTENTIAL FUTURE INVESTMENTS48

Dynamic Traffic Assignment (DTA) 48

Connected/Autonomous Vehicle (CAV) Modeling Framework 49

Introduction

The Indianapolis MPO (IMPO) engaged Caliper Corporation and City Strategies, LLC, to develop a Data, Modeling, and Analysis Program or Data RoadMAP as an update to the 2018 Data, Analysis, and Modeling (DAM) Program. The DAM Program provided a framework for significant MPO investments in data acquisition and model development from 2018 to the present.

During the three and a half years since that plan was initiated, the IMPO, in addition to continuing meeting its responsibilities as the Metropolitan Transportation Planning organization for the Indianapolis Metropolitan Planning Area, has also undergone a significant organizational change. On June 1, 2020, IMPO, which had been hosted by the City of Indianapolis – Marion County, Indiana, since its inception, became an independent regional planning organization. In addition to its FHWA/FTA MPO responsibilities, the IMPO will be supporting regional efforts in economic development, land use, housing, and water resources planning. These new planning responsibilities will require new data, modeling, and analytical supports. This need, together with rapid changes in federal transportation funding and priorities, has prompted the IMPO to develop this update to the current plan.

This Data RoadMAP is so named as it is intended to provide a roadmap for IMPO's investments in data, modeling, and analysis over the coming years. This document provides a list of recommended investments from 2022 through 2028, as well as some thoughts on potential investments beyond this period. These recommendations were developed in concert with IMPO staff through a series of coordination meetings.

The 2025 revision is halfway through the current plan and includes updates on the IMPO's progress thus far.

The specific items updated in this document include the OD data section, survey section, Transportation Improvement Program section, Strategic Modeling Section, and Land Use and Socio-economic Data Initiatives section:

- The OD Data section was updated to reflect the change from Streetlight data to Replica.
- The survey section was updated to account for the currently-underway Central Indiana Travel Survey project, and the section was expanded to include transit surveys (which IMPO and IndyGo have been collecting roughly every three years) as well as considerations for next steps for survey data collection.
- The Transportation Improvement Program section was added as a core data recommendation. This is related to updates with the current software setup that has the capability to collect data from users.
- The Strategic Modeling Section was updated to include progress since 2022.
- The Land Use and Socioeconomic Data Initiatives section was updated to reflect IMPO no longer using IMPLAN and LightCast.
- A note was added to discussion of CommunityViz regarding the uncertainty of its continued maintenance.

Data, modeling, and analyses are core functions of IMPO. The IMPO's quantitative work provides an objective basis for informing regional decision-making and investments in

transportation and other infrastructure. Measuring and predicting performance metrics is central to the goal of performance-based planning advanced in MAP-21 and the Bipartisan Infrastructure Law (BIL). Under the BIL, more discretionary funding is also made available. This increases the relevance and importance of conducting compelling benefit-cost analyses, which are frequently required or strongly encouraged in applications for federal discretionary funds. The BIL also places an increased emphasis on equity as a factor in transportation planning, and so this plan also addresses equity analysis. The recommendations advanced in this document are designed to support the MPO’s on-going performance-based transportation planning and its new initiatives in economic development, land use, housing and water resources planning, as well as position IMPO to compete for discretionary funding under the BIL.

The recommendations of this Data RoadMAP are organized into the following five sections:

- Traditional/Core Data Recommendations
- Recommended Analytical Studies
- Recommended Indianapolis Travel Demand Model (ITDM) Improvements
- Other Recommended Tools
- Recommendations for New MPO Initiatives

These are followed by the recommended budgeting for these investments and final section with some brief notes on possible investments beyond this period.

Traditional/Core Data Recommendations

This section identifies the key data recommendations to support IMPO’s transportation planning. Some of these data sources such as travel time data and safety data constitute key performance measures themselves, while others support the ITDM and thus, indirectly, the many performance measures it can produce.

OD & ADT Data

In the prior DAM Program, origin-destination (OD) flow data and average daily traffic (ADT) or traffic count data were addressed as two separate data elements for investment. At the time, OD data was being derived from passively collected “big” data; whereas, traditional ground counts were recommended for collecting ADT. However, traditional collection of ADT counts proved more expensive than anticipated. At the same time, it was demonstrated that ADT estimates derived from big data provided similar levels of confidence as traditional 48-hour ground counts (see Figure 1). Therefore, IMPO chose to acquire both OD and ADT data together from a big data vendor, Streetlight Data, at a substantial cost savings relative to maintaining a traditional count program. In recent years, Streetlight Data has moved to average-day output data. While this is okay for most analyses, the data loses its fidelity for single-day issues, such as the Indianapolis 500, which brings over 350,000 people to Speedway, Indiana, just northwest of the CBD. Because of this, IMPO has changed vendors to Replica, which includes OD flow data, AADT estimates, bicycle count estimates, and pedestrian count estimates.

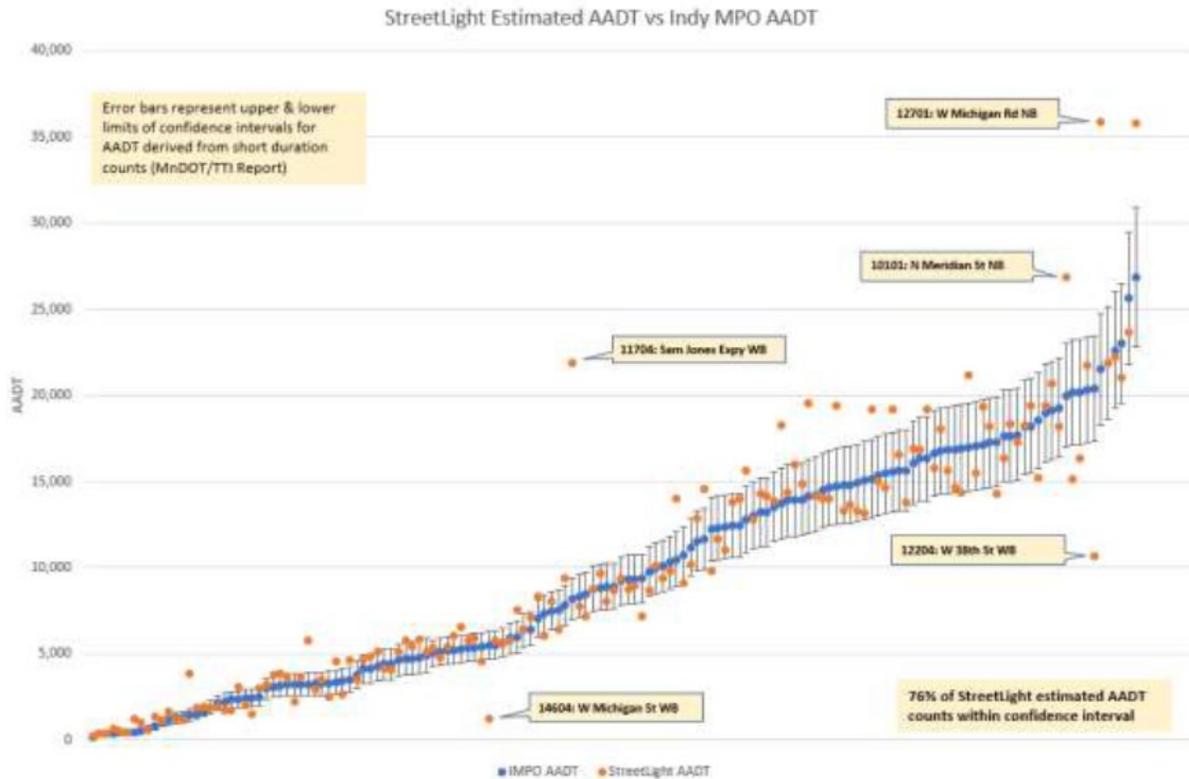


Figure 1. Streetlight AADT and acceptable percentage error bars plotted against IMPO AADT (source: Streetlight AADT Validation Technical Memorandum)

Inspired by the successful estimation of ADT, IMPO also licensed estimates of bicycle and pedestrian traffic from Streetlight. However, IMPO staff review of this data revealed substantial quality issues with the bicycling estimates. While both LBS data from smart phone apps and GPS data from vehicles can provide the underlying source data for ADT metrics, only the former can support bicycle and pedestrian traffic estimates. Additionally, only a relatively small proportion of LBS data contains frequent observations between origins and destinations capable of supporting mode imputation. There has been no successful validation of bicycle and pedestrian estimates from big data at scale similar to those for vehicular ADT.

Prior to this, IMPO had acquired passenger OD data from Resource Systems Group (RSG). Unlike Streetlight Data’s OD data, this data was expanded to substantial local count data, both short-term and continuous, and was processed to provide data consistent with the ITDM’s own trip purposes. This data was successfully used in updating the ITDM.

IMPO also separately acquired truck OD data from the American Transportation Research Institute (ATRI) which was processed and expanded by RSG. Although Streetlight Data also provides truck data, ATRI data can be processed in ways that Streetlight Data cannot. For instance, it is possible to remove intermediate stops at truck stops from through trips from the ATRI data to provide better estimates of external-external truck trips for modeling purposes.

OD flow data is currently being used by local planning agencies (LPAs) to support project development. Data from Replica (OD Flow, AADT, non-motorized counts) is not currently

used in model development, although IMPO has informally compared some INDOT AADT estimates with Replica AADT estimates and Replica has thus far been accurate.

Both OD flows and reliable estimates of ADT are foundational to transportation planning, contributing to two of the “pillars” of data, analysis, and modeling identified in the DAM Program. The Data RoadMAP therefore recommends that IMPO continue to annually license OD and ADT metrics derived from big data and ensure that ATRI data is used in future model updates. Acquisition of further bicycle and pedestrian traffic estimates from big data is not recommended until such time that this technology has been successfully demonstrated to be reliably accurate. ATRI currently has the largest sample of truck GPS data due to its unique relationship with the trucking industry as the research arm of the American Trucking Association. Therefore, the acquisition specifically of ATRI data rather than truck GPS data is generally more warranted. However, ATRI’s data does not currently differentiate between types of trucks and heavy, semi-tractor-trailers are known to be overrepresented relative to medium, single unit trucks. In the prior development of IMPO’s truck model, LBS data was able to be processed to identify medium and light trucks and commercial vehicles. However, due to decreases in LBS data density, it is not clear that this approach could be repeated with current LBS data. A new source of commercial data provided by Geotab also now provides a valuable resource for these smaller commercial vehicles. Alternatively, it may be possible to process ATRI data to infer vehicle types. Both of these approaches should be considered when it is time to acquire data to support the update of the truck model. It is desirable that IMPO require that its OD data be provided in the ITDM’s trip purposes (as they are recommended to be updated elsewhere in this document).

Travel Time Data

Travel times are also foundational to transportation planning and were identified as one of the “data pillars” in the DAM Program. Travel times serve both as performance measures directly (e.g., travel time to the nearest emergency room) and as components of or explanatory variables for predicting many other performance measures (e.g., accessibility, destination choices, etc.).

In recent years, various sources of travel time data have become available and are now increasingly used to support transportation planning. FHWA makes travel times on the National Highway System available for free to public agencies in their National Performance Management Research Data Set (NPMRDS) dataset. The MPO successfully used a licensed expansion of this data set (from the NHS to the entire TMC network) in its most recent ITDM update. Beginning in 2022, the IMPO now enjoys access to historical travel time data on an expanded network from INRIX courtesy of the Indiana Department of Transportation (INDOT). This data is adequate to support IMPO’s data needs, and therefore the Data RoadMAP does not recommend the acquisition of additional travel time data. However, were INDOT to cease providing this data, it would be recommended that IMPO acquire such data itself, as was recommended in the DAM Program. It is also recommended that, providing licensing allows, IMPO annually archive the travel time data (including the TMC shapefile) available from INRIX for its own records, should the data no longer be available at some point in the future. Moreover, it is recommended below in the section on ITDM improvements that the speed validation performed in the last ITDM update using NPMRDS data be updated using the more extensive travel time data now available from INRIX through INDOT.

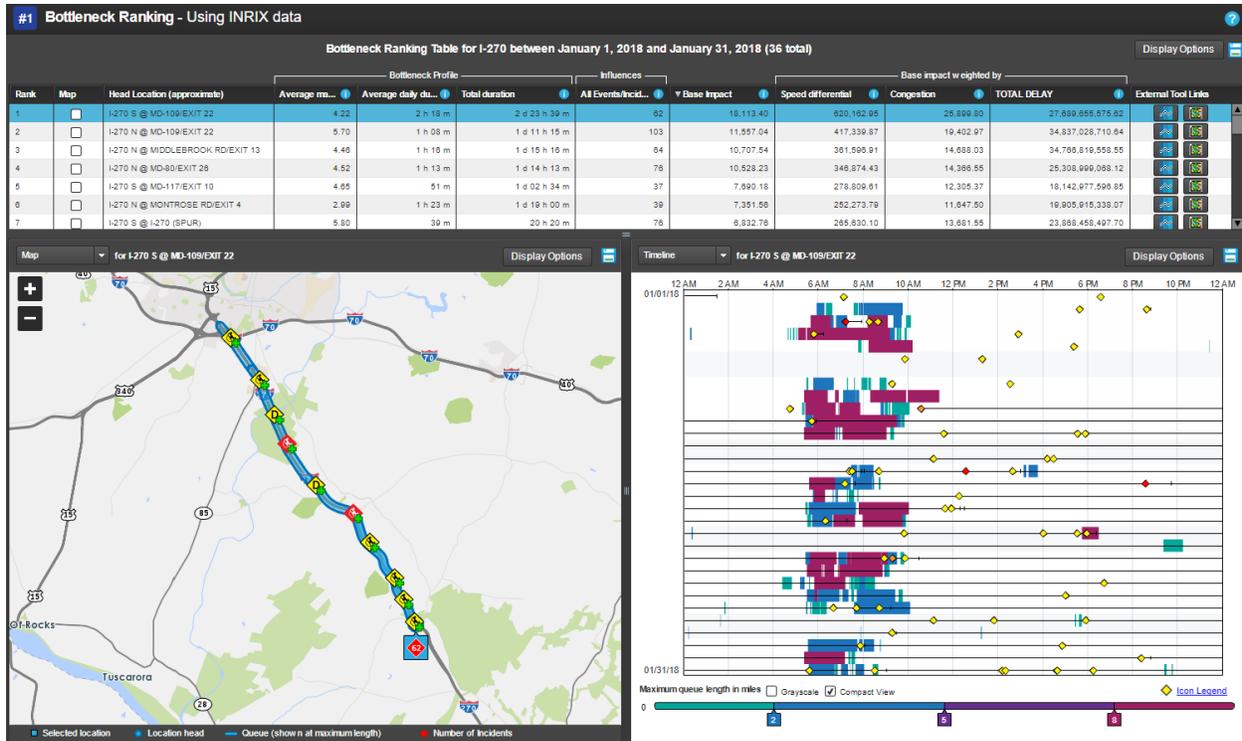


Figure 2. INRIX Travel Time Data Dashboard from RITIS (source: ritis.org)

Employment Data

Employment has long been a key explanatory variable in the choice of destinations in travel demand modeling, but employment and establishment point-of-interest (POI) data are increasingly also being used for accessibility performance measures, identifying activity centers, and the processing of passive data. Moreover, the Data RoadMAP is recommending that IMPO consider expanding its set of accessibility measures, making further use of this data.

Since the DAM Program, IMPO has taken to licensing employment data annually from Data Axle (formerly Infogroup). Although the DAM Program recommended purchasing this data every other year, its use in computing annual accessibility performance measures helps motivate the choice of annual updates, in addition to licensing restrictions on data archiving. For these reasons the Data RoadMAP recommends IMPO continue licensing employment data annually.

It is also recommended that the MPO develop and document a consistent process of data cleaning and validation. Manual verification of large employers and block level comparisons need not be done every year but should be done at least once per plan cycle. Annually, each iteration of the dataset should be compared to the previous iteration to check the reasonableness of changes.

The MPO also currently uses **Woods & Poole Economics** forecast data as a reference in constructing its forecasts. We recommend retaining the current annual license for the MPO's access to Woods & Poole Economics for the duration of the plan.

Safety Data

IMPO began a project in 2017 to correct the locations of the ARIES (Automated Reporting Information Exchange System) incapacitating injury and fatal crash records. As an outgrowth of that project IMPO created a crash data dashboard which it hosts on its website. The IMPO’s crash dashboard displays 7 years (2015 – 2021) of fatal and incapacitating injury crash records in the 8-county region. The dashboard enables IMPO’s Local Planning Agencies and the public to view the crash data with interactive filters, allowing the user to select a specific year, crash type, or jurisdiction. Each individual crash location can also be selected for further crash details as seen in Figure 3.

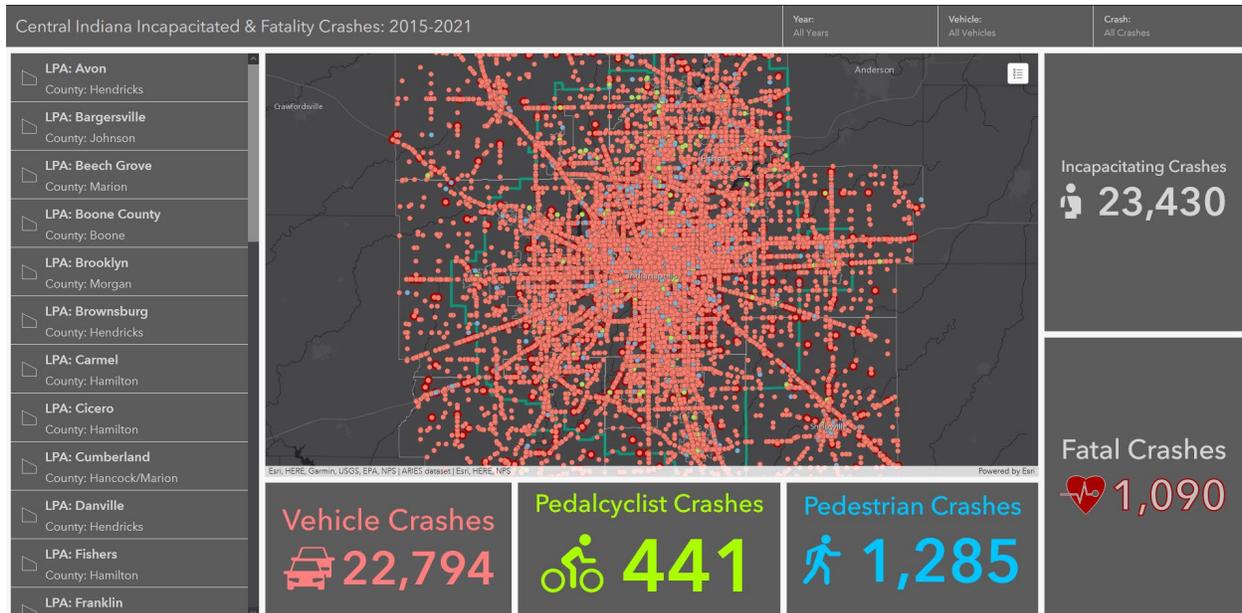


Figure 3. The IMPO's Crash Data Dashboard

These crash statistics are both a critical performance measure for the Metropolitan Transportation Plan (MTP) as well as a valuable resource to the LPAs and the public. As such the Data RoadMAP recommends that the MPO continue its annual cleaning and processing of the ARIES data to maintain its data dashboard.

Travel Survey Data

Travel survey data used at an MPO generally consists of two primary data sources: household survey data and transit survey data.

Household Surveys

IMPO and Madison County Council of Governments (MCCOG) coordinated to conduct a new Central Indiana Travel Survey. This allowed the two MPOs to be able to efficiently use financial resources by using one consultant team and reduce duplication of effort. The MPOs hired a team led by RSG to lead the data collection and post-processing efforts. The survey began field data collection in 2024 and is expected to conclude at the end of 2025.

While the survey data is still being collected and processed at the time of this update, it appears that the survey will reach its sampling goals. The RSG project manager noted that the outreach to low-income households, traditionally one of the more difficult segments to collect complete

data, has been doing better than the American Community Survey. This was attributed to oversampling and incentives. In addition to these efforts, IMPO has reached out to local media to inform the public about the survey, the use of the data, and the benefits to the public. Even if sampling targets are met, IMPO should pay attention to the survey response rates. Survey response rates have been falling for some time but have dropped significantly further since COVID. Surveys with extremely low response rates (<5%) are apt to contain biases similar to those from volunteer sampling. It is worth noting that ETC Institute has demonstrated some significant success in achieving cost-effective higher response rates through multichannel recruitment and reduced reliance on mail-based recruitment.

Household travel surveys are expensive, with prices ranging in the \$1-2 million dollar range for a large MPO. Because of this high cost and the difficulty of budgeting for it, it has been over 15 years since IMPO's last household survey in 2009. There is not a specific timeframe for survey data collection prescribed by FHWA or INDOT, but most large MPOs collect a survey every 10 years. This would mean another household travel survey in 2035. In part due to the difficulty of budgeting such a large expenditure every ten years or so, an increasing number of MPOs are shifting to smaller but more frequent survey collection, most typically every other year. This has the dual benefits of spreading the financial burden of the data collection more evenly over time as well as providing fresher data and an ability to monitor trends and changes in travel behavior, such as the level of remote work from home. There can also sometimes be some small cost savings with this approach since the survey instruments should be kept constant as much as possible to allow for data analysis and combining. Rather than wait until the mid-2030's, IMPO may therefore want to consider initiating a series of surveys beginning sometime from 2028 to 2030 so that adequate data will be accumulated to support a major model update in the mid-2030's.

Another approach to model data updates is to continue the manner currently in use by the MPO. In 2020, IMPO contracted with RSG to update some parts of the model – specifically destination choice and nonhome-based trips – using big data (the same project also included the development of the freight and commercial vehicle model in the IMPO travel demand model). Big data is a larger data source than a traditional household survey, although it lacks the detail of a household survey regarding household and mode choice data. In many cases, household models (such as auto ownership and trip generation) can be adjusted based on Census data and analysis with expanded big data and the expanded transit survey, which can be used to recalibrate the mode choice model.

The decision of which approach is as much a financial decision as it is a technical decision. Between the survey approaches (at least one per decade vs. smaller and more frequent samples), there is no evidence that one is better than another. Using big data to “fill in” between large surveys has worked for IMPO in the past.

Transit Surveys

IMPO and its transit agency partners have conducted transit on-board surveys at a frequency of roughly every three years since at least 2010. While these are occasionally moved around to account for changes in travel or the transit network, the data coverage is comprehensive.

In the 2020 model update, this data was not utilized since the project did not include significant changes to the mode choice model.

Our recommendation is to continue gathering this data. If big data is used in other parts of the model to “fill in,” ensure transit survey data is used to check and potentially recalibrate mode choice.

Transportation Improvement Plan Data

IMPO uses MiTIP from EcoInteractive to collect data about potential projects for inclusion in the TIP. The data that is collected includes the project’s location (input on a web map by the applicant) and data that is specific to the funding type of the project. As such, some of the data that is required for one type of funding, such as Highway Safety Improvement Program funding, may not be required for other types of funding, such as Surface Transportation Block Grant funding. Additionally, some of the data input may not be standardized – traffic volume, for instance, may be provided as a turning movement count or an estimated AADT (roadway count) from StreetLight or Replica. Ultimately, this TIP data is used in a prioritization process during each TIP cycle of two years. This prioritization is necessary because the TIP covers a range of four years, and all projects must be funded based on the current available funds provided by FHWA and INDOT.

In many cases, TIP data does not bring new information to the travel demand model. For a project to be included in the TIP, it must also be included in the IMPO Long Range Plan (LRP), and the capacity-improvement projects reasonably determined to be budget-able must be evaluated in a travel demand model. However, the TIP application process can be used for data collection for before-and-after studies. The Data RoadMAP recommends that IMPO determine a base set of easily collected information for all projects, such as AADT estimates and crash data that can be referenced and collected from IMPO or INDOT-supplied tools.

Recommended Analytical Studies

In addition to the acquisition and collection of data, itself, several analytical studies are recommended as part of the IMPO Data RoadMAP.

Safety Studies

When U.S. Department of Transportation (USDOT) published a notice of funding opportunity for the Safe Streets and Roads for All (SS4A) Discretionary Grant in May of 2022, IMPO was prepared and able to produce and adopt a Safe Streets and Roads for All Safety Action Plan by August so that the MPO’s LPA partners were able to submit for SS4A construction grants in September. This was possible because of the MPO’s maintenance of its safety data and the 2019 Safety Study: Road Safety Audit of High Crash Intersections. This study followed a similar, earlier study in 2016, and prior to the Data RoadMAP IMPO was already planning on another such study in 2023. The Data RoadMAP recommends that IMPO continue conducting these safety studies every three years to continue to support its Safety Action Plan and ensure continued regional eligibility for discretionary safety funding.

Strategic Modeling

Strategic tools are designed to address a wide range of trends and policies, rather than focusing on details. As a result, many alternative futures and policies can be evaluated. Strategic models such as VisionEval can address policies related to intelligent transportation system (ITS), pricing of Vehicle Miles Traveled (VMT) or parking, and a variety of travel demand management (TDM) policies that are challenging to represent in regional travel models such as the ITDM. Strategic models can also help support land use visioning and scenario planning regarding urban form similar to the visioning exercise IMPO engaged in to support its MTP. Given these uses, the DAM Program recommended the MPO consider investigating VisionEval. The Data RoadMAP continues to affirm the potential value of strategic modeling, while also recognizing its nature as a secondary or auxiliary tool to complement the ITDM.

This Data RoadMAP initially recommended that IMPO develop a VisionEval model in 2025, and as of December 2025, IMPO and RSG are nearing the completion of the model. This model is configured with six categories to evaluate:

- Land Use
- Active Travel
- Teleworking
- Demographics
- Electrification
- Transit

Each of these categories has up to four levels, each has a reference level and 2-3 levels building on each category.

As of this revision, the Data RoadMAP recommends that IMPO continue developing and testing the VisionEval model. Upon successful completion of VisionEval testing, IMPO should investigate if there are opportunities to use VisionEval to inform the ITDM.

Before & After Studies

A critical element of truly performance-based planning is monitoring to ensure that the selected projects produce their intended outcomes. Rigorous before-and-after studies which quantify service (travel times) and demand (traffic, bike/ped counts or transit ridership) are crucial to improving the MPO's modeling and analysis capabilities and ultimately ensuring that the best possible projects are selected. For example, the requirement of before-and-after studies of rail transit capital investments by the Federal Transit Administration (FTA) led to dramatic improvements in the accuracy of transit forecasts. For this reason, the DAM Program recommended that IMPO explore before-and-after studies to improve its modeling, analysis, and planning processes.

The Data RoadMAP recommends that IMPO continue to conduct these important studies and periodically review the individual before-and-after studies together as a group to identify any common issues and possible improvements to its data collection, forecasting, and project selection processes.

Recommended ITDM Improvements

The Indianapolis Travel Demand Model (ITDM) should be a valuable tool to support various MPO functions including scenario analysis, corridor studies, subarea studies, project prioritization, the MTP, and various other plans. At the time of the DAM Program, the ITDM was a traditional trip-based (“four step”) model. The DAM Program recommended incremental improvement of the ITDM to a hybrid model, where some model elements are disaggregate tour-based and some model elements are traditional aggregate trip-based. The first step toward this was taken in the last model update with the linkage of home-based and non-home-based trips. Further advances were recommended for a more significant model update slated for 2023-2024.

Most MPOs of Indianapolis’ size conduct major model updates once a decade or every second or third plan cycle. A major model update requires travel behavior data collection, re-estimation of core passenger model components, and significant rewriting of the model code. The passenger components of the ITDM, despite some updates, are still largely based on the 2009 household survey. Hence, a major model update is due, and travel behavior data collection to support a major model update was included in the Traditional/Core Data Recommendations of the Data RoadMAP. A major model update presents an opportunity to improve the ITDM in ways that are not possible through more minor updates. In this section the Data RoadMAP presents a series of recommended improvements to the ITDM.

The DAM Program also recommended, and IMPO carried out, a major investment in the freight model components in 2020. The freight components of the ITDM are therefore not recommended for update until 2027. Keeping the freight model updates on a separate cycle from the main passenger model components helps spread model maintenance costs more evenly across years.

Master Network

Many MPOs and DOTs use a master network to help manage their network scenario coding. Master networks ensure that projects are coded consistently across all scenarios to which they belong and can eliminate redundant efforts of coding the same project in multiple scenario networks. Therefore, the Data RoadMAP recommended the ITDM shift its network management approach to use this master network solution. This does not require data collection or other elements of the model to be updated therefore it can be advanced prior to the major model update. This has now been implemented as of the revision.

Speed Calibration

Accurate network speeds are critical to a travel model’s ability to produce good traffic volumes and accessibility measures. The most recent model update completed by RSG did include some basic speed calibration but only against the speeds from NPMRDS. As IMPO now has access to speed and travel time data over an extended network, it is recommended that the speed calibration be revisited in anticipation of the next model update. As shown in Figure 6 below, the previous model calibration showed poor fit to ramp speeds and important outliers among freeways and expressways and was not able to make a meaningful evaluation of collectors and local streets due to sparsity of the NPMRDS data. A new speed calibration would involve conflating the INRIX travel time network to the ITDM network, comparing the modeled and observed speeds, and adjusting the ITDM to better reflect the observed speeds.

These adjustments could take a variety of forms including adjustments to free flow speeds for certain link categories, stratifying link categories by posted speed limits, adjustments to volume-delay function parameters, or link-specific adjustments to deal with outliers.

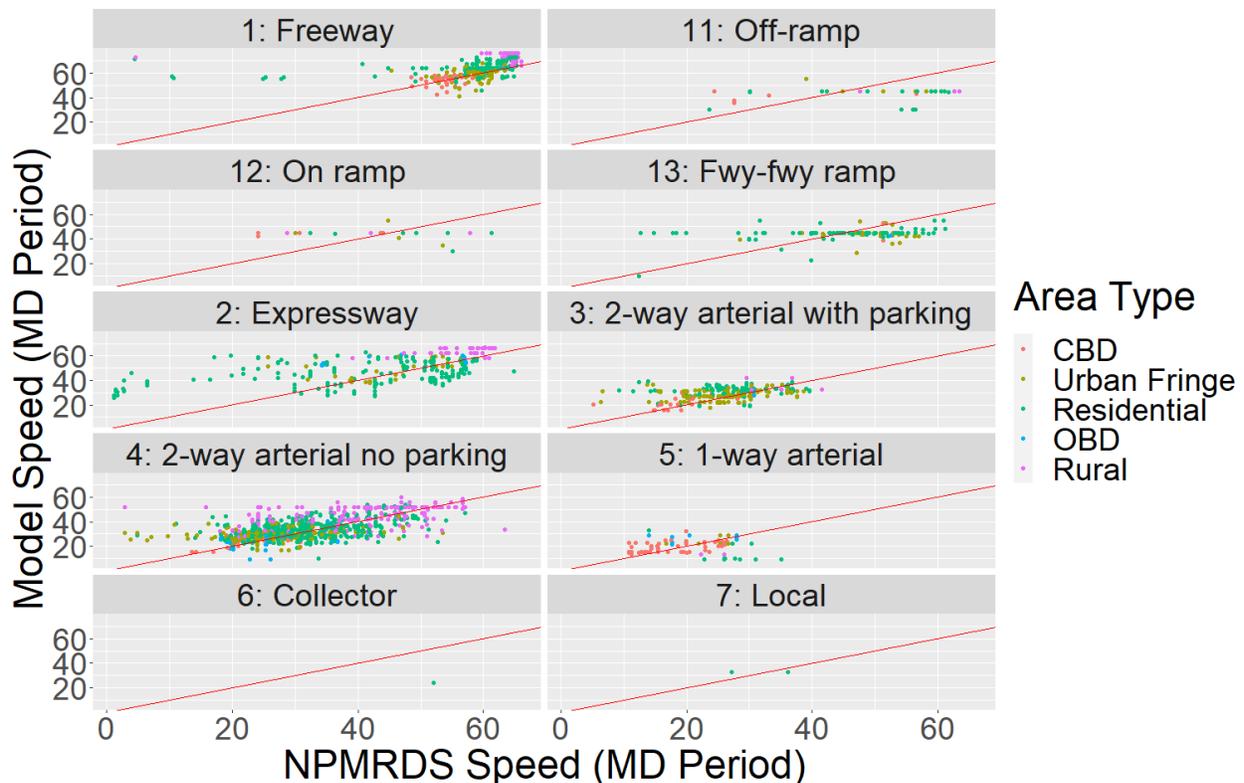


Figure 4. Speed Calibration from the Most Recent Model Update

Some speed calibration was conducted prior to this revision and more is currently underway as a part of the ITDM update.

Population Synthesis

Over time there has been a shift away from applying demand models directly to entire traffic analysis zones in favor of representing individual households and persons and modeling travel behavior at their level. This shift began with using cross-classification models rather than aggregate regression models and now involves the development of synthetic populations in many advanced models. The basic fact that people travel, and not zones, drives this shift. Technically, the shift is to avoid the aggregation bias that occurs when nonlinear demand models (such as nonlinear regression or logit models) are applied to aggregate or average characteristics rather than to populations with a range of attributes around their group averages. For example, a mode choice model may predict no significant transit mode share when applied to a zone with 100 households with an average of 2.2 cars per household. However, the same mode choice model, applied to the same households individually, may predict a significant number of transit trips if five of the households have no vehicles and 15 have only one vehicle. Examples like this illustrate that the effects of aggregation bias can be quite significant and have helped motivate the shift to more disaggregate modeling. Based on this, the DAM Program recommended that a population synthesizer be added to the ITDM for the next major

model update. The Data RoadMAP reaffirmed this recommendation, and it has been implemented as of this revision.

Disaggregate Trip Generation

The desire to minimize aggregation bias which motivates the development of a synthetic population, likewise motivates a shift to disaggregate trip generation modeling, which is usually done when a synthetic population is developed for a model. Disaggregate trip generation models can be at either the household or person level, but person level models may be preferable as they allow more direct use of age and other person variables, which are significant in determining trip-making. Disaggregate trip generation models can also take a variety of mathematical forms including general linear models (most commonly negative binomial regression), ordinal logit models, or more recently, decision trees. All of these models represent an advance of traditional cross-classification as used in the existing ITDM in that they allow for the use of more than two explanatory variables in predicting trip rates. In a recent model development project for a similarly sized MPO, Caliper was able to test and compare cross classification models with general linear models, ordinal logit models, and various types of decision trees. The decision trees significantly outperformed the other model forms in terms of goodness-of-fit to the data. However, the best fit models were complex and not necessarily intuitively plausible. Therefore, simpler, “rationalized” decision trees were ultimately preferred and used. These rationalized decision trees used ANOVA as their trainer with some human pruning to ensure the models reflected a rational model of human trip-making behavior. Based on this, we recommend the ITDM be updated to use rationalized decision trees for trip generation. An example rationalized decision tree model is shown in Figure 7 below.

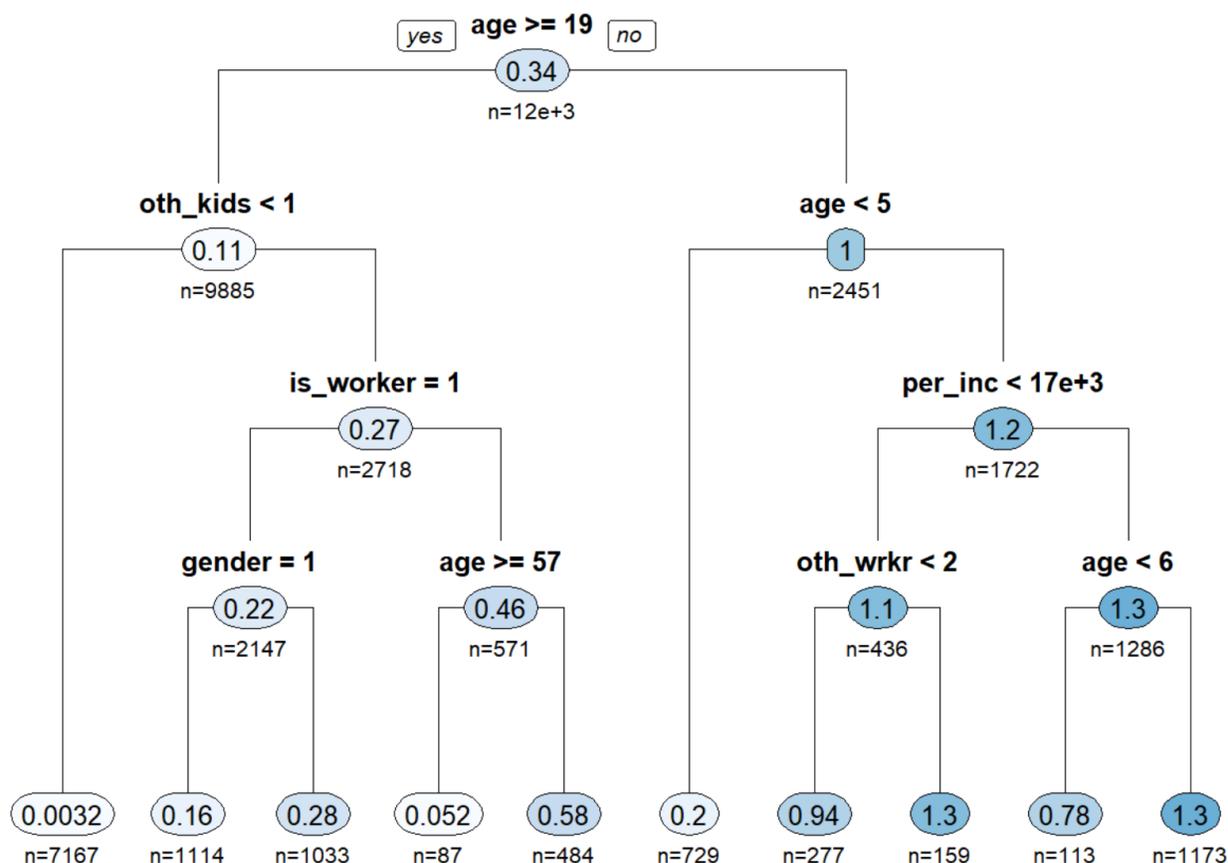


Figure 5. Example of a Simple, "Rationalized" Decision Tree for School Trips

Also under the topic of trip generation, we recommend that the new model continue to incorporate hybrid modeling techniques by segmenting its trip types or purposes between those on work tours and those on non-work tours.

Market Segment Tracking

While the IMPO's current approach allows some consideration of market segments of interest, it remains rather crude and limited in its ability to provide insights into the travel patterns of distributional impacts or how transportation investments would or would not benefit particular market segments. Therefore, we recommend that the ITDM be updated to be able to track market segments through the model so that project benefits can be attributed to them. This requires that when the trips are aggregated after trip generation that separate matrices be maintained for market segments of interest in destination and mode choice and that they be assigned as separate classes in the highway assignment. This will increase the disk space required for model outputs and slightly increase model runtimes but will allow benefits such as crash costs and vehicle operating costs to be attributed to market segments supporting robust distributional analysis.

Work-from-Home Module

Although there has been a steady increase in the number of people working from home (WFH) for many years, the COVID-19 pandemic both accelerated and highlighted the importance of the trend. The original DAM Program, being developed prior to the pandemic, did not give thought to modeling WFH as it was not common practice at the time. However, since the pandemic, many MPOs have incorporated modules for WFH into their models to allow them to test a range of scenarios with differing levels of work from home. Given the increasing and uncertain level of WFH, the Data RoadMAP recommends that a module be developed to allow the ITDM to test a range of WFH in the future.

E-commerce Module

The rise of e-commerce and the substitution of home delivery for traditional shopping and eating out was similarly accelerated and highlighted by the pandemic. It is now recognized that this is the largest on-going shift in travel behavior and patterns and is resulting in a significant decrease in household travel and increase in commercial travel (see Figure 8). While new data collection supporting the model update will provide a snapshot of current travel behavior which the ITDM can pivot off of, it needs a special module to allow the model to explore how the trend might play out rather than simply assuming that things will always remain like when the data is collected in 2023. The module would provide a link between the passenger and commercial vehicle components of the ITDM, shifting demand from household shopping and eat out trips to commercial vehicle home deliveries.

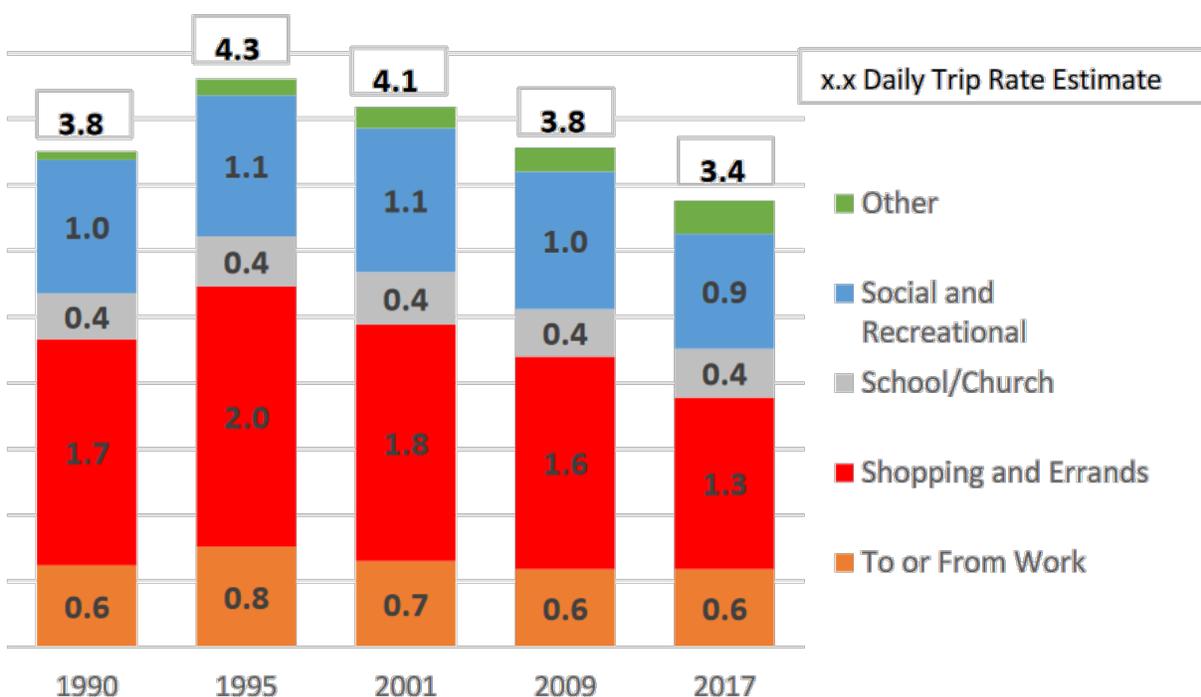


Figure 6. Trip Rate Trends from the NHTS Highlighting the Marked Decrease in Shopping

Dynamic Segmentation

The existing ITDM segments travel markets are based on income and auto ownership, and nests mode choice under / after destination choice. Each market segment is run separately

through first destination and then mode choice in parallel so that income and auto ownership can be used in mode choice. This is the common state-of-the-practice approach.

However, despite its widespread use, this approach is behaviorally implausible and fails to take advantage of the synthetic population available in a hybrid model prior to destination choice. The traditional nesting of mode choice under / after destination choice implies that people are more likely to change their mode than their destination. There is significant evidence that in the United States (and even in Sweden which is a much more transit friendly environment) that travelers are more likely to change destinations than modes, with mode choice a forgone conclusion upon which destination choice is made. For this reason, a few MPOs have adopted reverse hierarchy models with destination choice nested under mode choice. However, the reality is surely that some people are more likely to change destination than mode and others the reverse. This complex reality can be modeled accurately with a fairly simple latent class structure that dynamically segments the synthetic population before proceeding with destination and mode choices. An example latent class structure is shown in Figure 9 below.

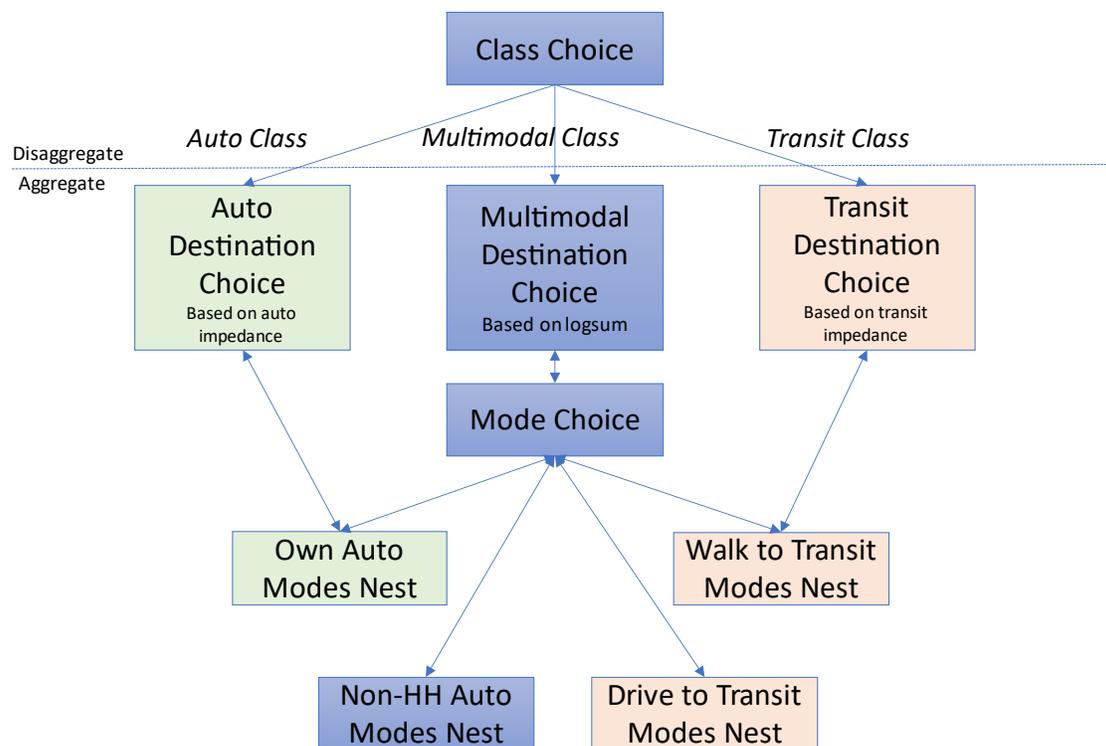


Figure 7. Example of a Possible Latent Class Dynamic Segmentation Approach

In this alternative approach, a disaggregate class choice model would divide the synthetic population into auto dependents, transit dependents, and multimodal choice-makers. In doing so, the mode would have access to the full set of variables in the synthetic population including, for instance, disability and drivers license ownership, as well as auto ownership. The transit dependents would then make their destination choice purely on the basis of transit travel times, producing more realistic destination choices for this population. Similarly, auto dependents' destination choice would be based on auto travel times; whereas, multimodal choice-makers would use the mode choice logsum, combining information on both auto and transit travel times. Adopting this approach would be a modest effort and would result in a far more

behaviorally rich and realistic model. At the same time, it is a novel innovation that may not be supported by the smaller survey recommended. Therefore, it is recommended tentatively as part of the next major model update if funding allows.

Destination Choice Improvements

The current ITDM has destination choice models, but they remain mathematically and functionally equivalent to gravity models because they have not incorporated any additional explanatory variables beyond attractions/size variables and impedance. The general superiority of destination choice models over traditional gravity models comes from their ability to incorporate additional variables and choice structures that impact destination choice. As the destination choice models should be re-estimated from fresh data as part of the next major model update anyway, the opportunity should be taken to incorporate additional variables. The first and simplest improvement would be to test and incorporate psychological barrier effects. It has been repeatedly demonstrated that destinations on the far side of psychological barriers such as rivers, county lines, and major highways are perceived to be farther away than they actually are. This affect can be captured in destination choice models and should be incorporated in those of the next generation ITDM. The second type of variables that could be incorporated in destination choice are accessibility variables. These powerful variables can be used to capture a variety of effects including spatial autocorrelation, the convenience of trip-chaining, and differential willingness to travel based on home location. Lastly, our recent experience has found that nested destination choice models significantly outperform non-nested models. In nested models, destinations are grouped in districts and the model simulates first the choice of district and then of precise destination zone. We therefore recommend that when the ITDM’s destination choice models are re-estimated as part of the next major update, that nesting be tested and both psychological barrier and accessibility variables be incorporated.

Mode Choice Improvements

Beyond the improved behavioral fidelity offered by dynamic segmentation, several improvements to mode choice are also recommended. Firstly, as a part of the update of the ITDM mode choice models, the transit nest of the mode choice model should be re-estimated from the latest onboard survey. This would help ground the model’s treatment of transit in the most recent local data.

The second recommendation is that a Transportation Network Company (TNC)/taxi mode be added to the model. Although their growth was dampened by the pandemic, the emergence of Uber and Lyft as mobility-as-a-service providers is still a significant development that should be represented in the model, and most



MPOs of Indianapolis’ size or larger are now including a TNC/taxi mode. Part of the reason for including this emerging mode in models is to capture and better understand the competition between these modes and public transit. There is some evidence that at least part of the decline in transit ridership in recent years is linked to the growth in this new mode.



Figure 8. The DataMAP recommends making ITDM's Walk and Bike Modes Sensitive to the Built Environment (source: Regional Pedestrian Plan 2020)

The third recommendation for mode choice improvements is to improve the modeling of non-motorized modes in the ITDM. While the current ITDM does include walk and bike modes, the choice of these modes is currently based only on the distance of the trip, with shorter trips more likely to be by walk or bike. In order to both make the model more realistic and accurate as well as make the model more sensitive for scenario analysis, it is recommended that the mode choice for walk and bike be made sensitive to the built environment through the use of a walkability variable. Although it is possible to attempt to make the model sensitive to multiple “4D” variables, in practice this proves difficult because of multicollinearity and it makes the creation of scenarios more difficult as well. So, we recommend using a single walkability variable instead. For the base year, the walkability variable should be computed based on a combination of “4D” variables, but for the future year, scenarios can be created by borrowing walkability scores from existing areas for which the future zone in question is anticipated to be comparable. Some MPOs model the choice of non-motorized modes prior to destination choice, and we also recommend that IMPO consider this in the next model update as well. This approach is both more likely to be behaviorally correct and gives the model access to synthetic population variables as well.

A fourth, minor recommendation is that the new survey data be examined and if warranted, a mode added for borrowed cars. The phenomenon of borrowing cars is often a non-trivial mode of transportation for low income households without cars of their own. It is distinct, however, from using an owned car as it requires coordination beyond the household. Thus, its inclusion as a distinct mode can allow more realistic modeling of mode choice for carless households.

The addition of one or more modes for e-scooters and e-bikes was also considered in the development of this Data RoadMAP. However, given the very small mode share claimed by these modes currently, and the fact that they compete mostly with walk and bike modes, we

are not currently recommending the inclusion of these micro-mobility modes in the next update of the ITDM.

Freight Model Update

The ITDM's freight model was significantly updated in 2020 as recommended by the DAM Program. For this reason, it is not recommended to be updated again as a part of the major update to the passenger models in 2024-2025, aside from the integration of an e-commerce module and the possible collapsing of the truck assignment classes to save runtime. However, given the rapid pace of the evolution of commercial vehicle travel, it is recommended that the model be updated again later in the decade. No changes are recommended to the model form, but a round of fresh data processing and recalibration of the model's parameters should be undertaken to ensure that the model remains current.

Other Recommended Tools

Most of the following recommended tools can be considered “post-processors” to the ITDM as they would use its outputs and ideally be integrated with ITDM for ease of execution; the notable exception to this being the CommunityViz tool, which is an ESRI-based tool that serves to help develop the land use inputs to the ITDM.

CommunityViz and Ancillary Tools

The DAM Program recommended that IMPO develop a CommunityViz model and land use visioning process which the MPO did in support of the most recent MTP update. The CommunityViz model was a valuable asset for the MPO which can be updated and used to support future MTP updates, and the Data RoadMAP recommended just that. The Data RoadMAP recommended that the CommunityViz tool should be updated to reflect the latest land use data and used to support another round of visioning in support of the next MTP update.

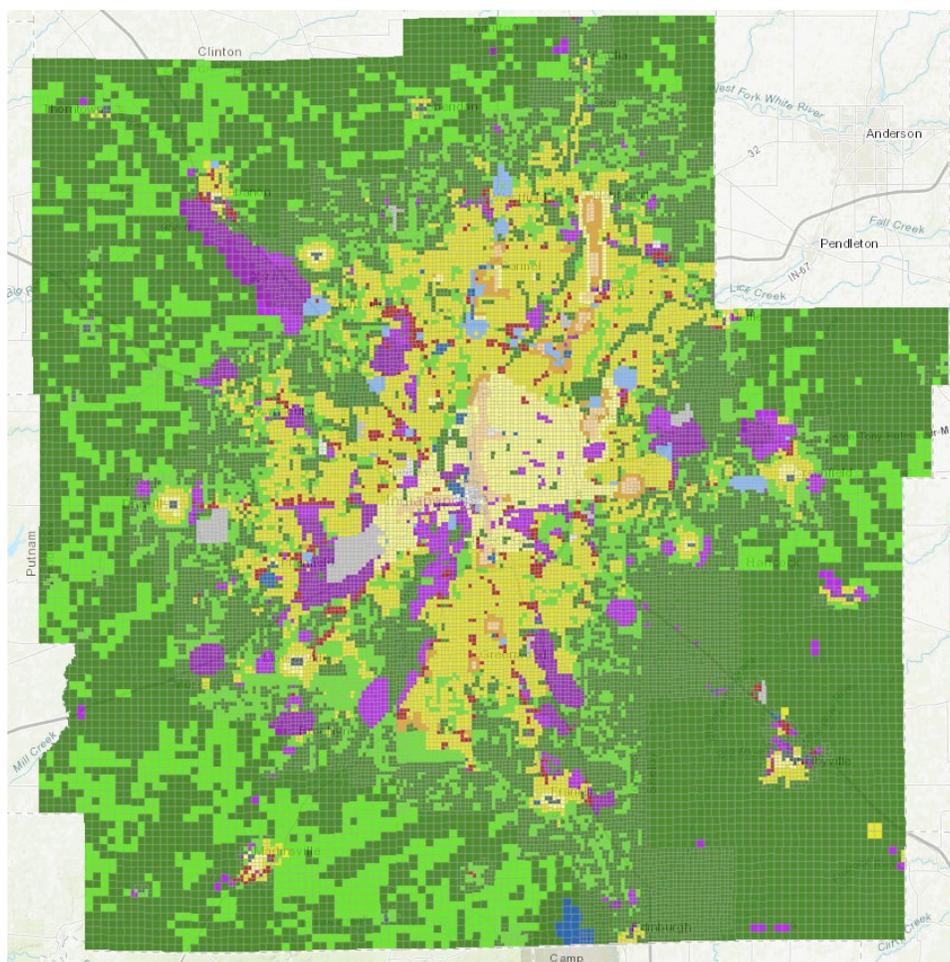


Figure 9. CommunityViz Placetypes from the Preferred Scenario for the 2050 MTP

However, as of this revision of the Data RoadMAP, CommunityViz has not developed a new version for use with ArcGIS Pro, and it is uncertain when or whether the software will be updated. It is important that IMPO be aware of this situation and that it may be necessary to transition to an alternative tool or software to support land use visioning for the region.

Benefit-Cost Calculator

Benefit-cost analysis is one of the more powerful ways that travel models can be used for the justification and prioritization of projects. The monetization of benefits and impacts, though not without its challenges and pitfalls, creates a level playing field on which the various impacts of a single project or the impacts of multiple projects can be compared. Under the BIL, benefit-cost analysis is playing an important role in winning discretionary federal funding, and so this Data RoadMAP echoes the recommendation of the original DAM Program that IMPO develop benefit-cost analysis capabilities.

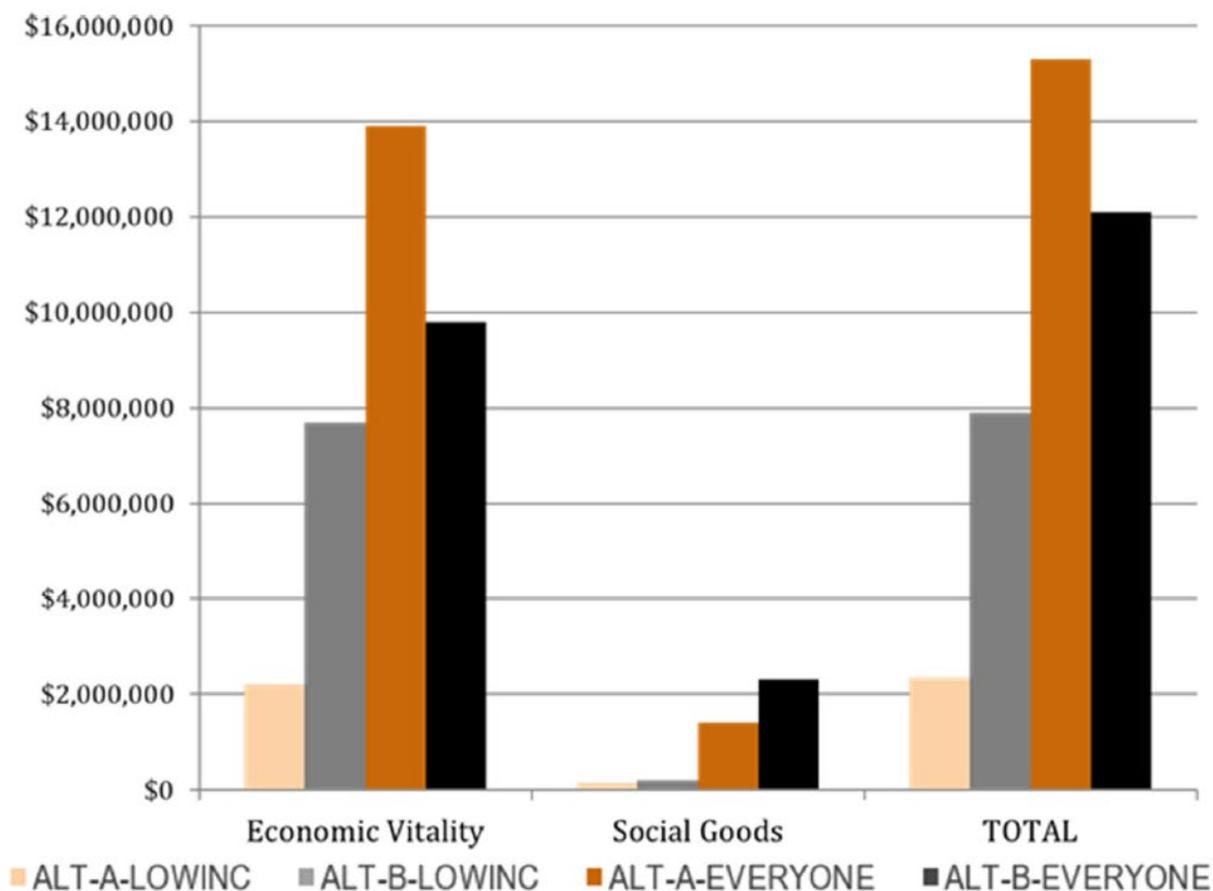


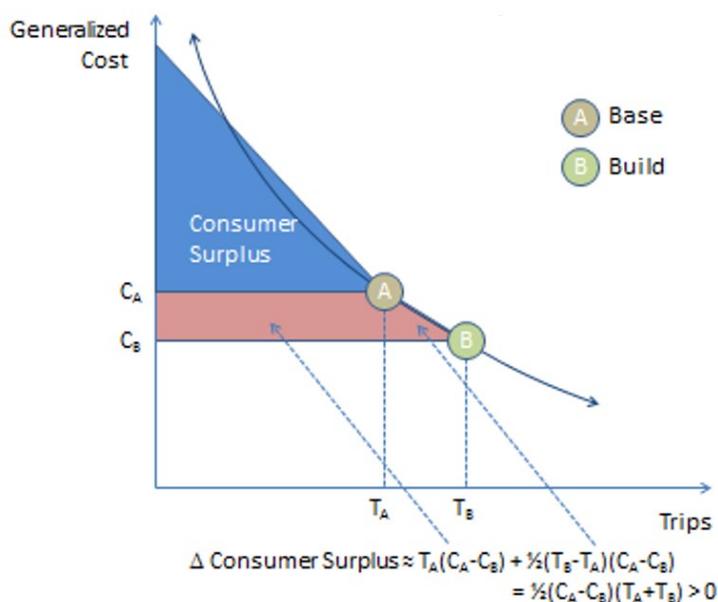
Figure 10. Comparing Benefits of the General Public and Low-Income Populations

In the past, benefit-cost analysis has been criticized for omitting environmental, social, and other benefits/impacts that are difficult to monetize. In response to this, recent efforts have been made to develop benefit-cost analysis tools that include a more comprehensive set of criteria, more comparability between criteria, more explicit priorities, and more explicit equity analysis. These more comprehensive benefit-cost analyses, sometimes cast as multicriteria evaluations, often estimate a quantitative “triple-bottom-line” (economic, environmental, and social/equity) of transportation investment scenarios. A contemporary comprehensive tool will include traditional benefit-cost analysis (BCA) benefits such as travel time savings, vehicle operating costs, safety, and emissions, as well as new benefits such as travel time reliability, vehicle ownership costs, noise and surface water impacts, the health benefits of

physical activity, and accessibility improvements as the options value of additional mode and destination choice alternatives. To the extent possible, the tool should also report the benefits specifically accruing to market segments of interest to support distributional analysis. The extent to which benefits can be attributable to specific market segments versus the general public will depend on whether the ITDM is updated to include tracking of these market segments as is recommended.

Safety analysis is one important component of any benefit-cost analysis, as well as producing valuable performance measures in its own right as a standalone tool. In recent years, most safety analyses have made use of the methods from AASHTO’s Highway Safety Manual (HSM). It is recommended that IMPO’s tool also adopt this approach, allowing for the use of user-specified crash modification factors, and calibrating the tool to local crash data.

Emissions analysis is another key component of most contemporary benefit-cost analyses and another source of key performance measures. IMPO wisely has maintained its ability to conduct emissions analyses with MOVES, and this functionality should be harnessed as a part of benefit-cost analysis, with the MOVES analysis providing fuel consumption rates for vehicle operating costs as well as emissions.



While it is easy to estimate travel time savings using the change in Vehicle Hours Traveled (VHT) from a model, this simple method underestimates the true benefit from an economic perspective because it penalizes the savings for induced travel, which is actually a benefit if people can make new or longer trips than they could otherwise. To properly account for this, the economic concept of consumer surplus must be applied. In practice, this is done by linearizing the demand function and applying the “Rule of Half” which entails attributing half the travel time savings

Figure 11. Illustration of the Rule-of-Half for Estimating Consumer Surplus

of existing trips to induced trips.

In more recent years, travel time reliability benefits have also been accounted for in addition to direct travel time savings. Most commonly, this is done by applying a value of time to the reduction in a buffer time (the amount of extra time that must be budgeted to assure an on-time arrival with reasonable confidence). Methods for estimating buffer time have been developed in several FHWA SHRP2 projects including L03, L04, L05, and L11 as well as in AASHTO’s Redbook. A meta-analysis of these studies created a composite or compromise estimate of buffer time as a function of volume-to-capacity ratio, which could be used to estimate travel time reliability benefits from the ITDM (see Figure 14).

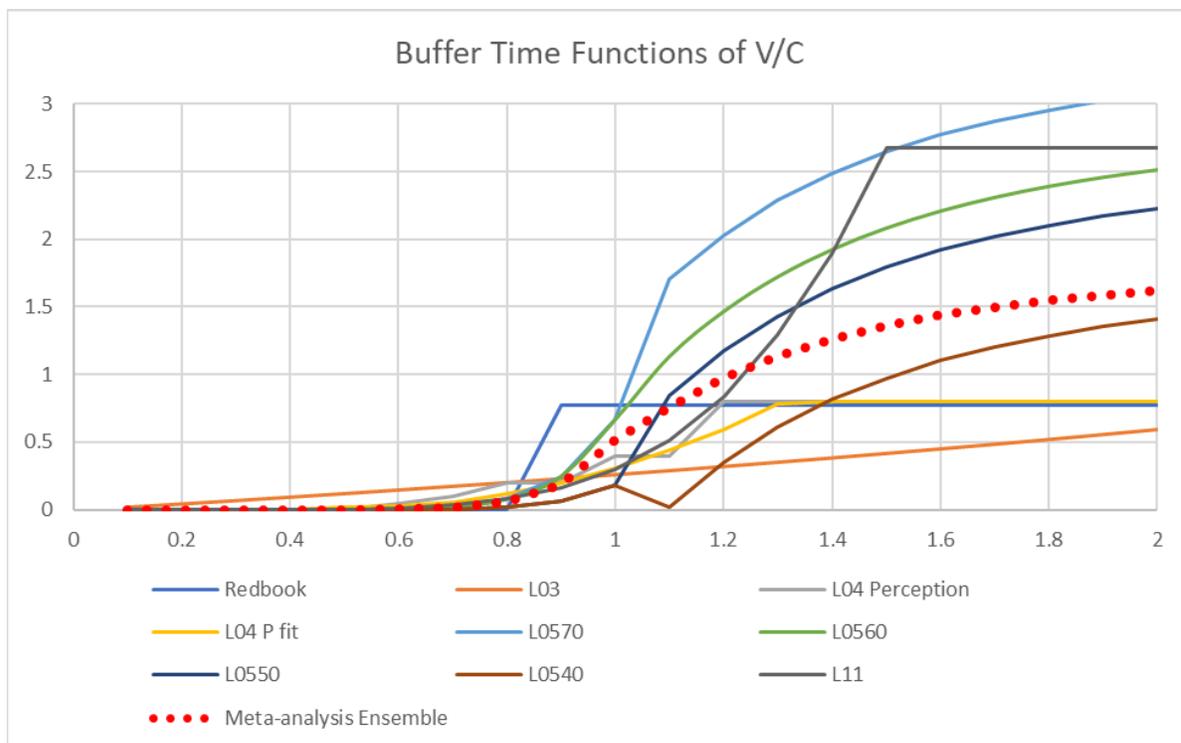


Figure 12. Meta-analysis of Travel Time Reliability Functions

Vehicle ownership and operating costs are two further key components of economic analysis. Traditionally, these costs have often been combined and based on VMT. More recently, as auto ownership modeling has become more common, ownership costs have been more appropriately modeled directly. The ITDM’s auto ownership model could support this approach and be used to estimate vehicle ownership costs. This way, if transit or pedestrian improvements lead to marginally lower vehicle ownership in the ITDM, the benefit can be captured and monetized. The remaining vehicle operating costs are generally divided into fuel and non-fuel costs. The fuel costs can be modeled using fuel consumption rates from MOVES, produced at the same time as the emissions estimates. Non-fuel costs are typically based on VMT and per-mileage cost estimates from the American Automobile Association (AAA) and ATRI.

The public health benefits of active transportation can also be estimated based on the World Health Organization's (WHO) Health Economic Assessment Tool for Walking and Cycling (HEAT) using the amount of walk and bike travel predicted by the ITDM. While the DAM Program recommended the ITHIM model of public health benefits, this more complex model is not necessary for estimating public health benefits of active transportation, and this Data RoadMAP recommends the use of the HEAT model in light of its lower implementation costs.

Surface water pollution and noise are two typically smaller impacts in monetary terms, but their inclusion in the accounting of project benefits and impacts helps ensure a robust and comprehensive evaluation process. Simple VMT-based methods of estimating these impacts have been documented in AASHTO’s Redbook and the by the Victoria Transportation Policy Institute, and can be easily employed to help complete a benefit-cost post-processor for the ITDM.

Accessibility benefits can be estimated using the logsums of the ITDM’s destination and mode choice models and can be understood as the value of having more destinations or modes available to choose from within a given travel time budget. This benefit can sometimes be over and above the value of travel time savings, even accounting for consumer surplus.

Accessibility Tool

As recommended by the DAM Program, IMPO developed accessibility measures based on ITDM model results, and has used its outputs as regional performance measures for metropolitan planning. The Data RoadMAP recommends several improvements to the measures. First, it recommends that additional accessibility measures be computed. Potential measures include the percent of the student-aged population within walking distance of a public school, percent of seniors within walking, transit, or drive thresholds of a pharmacy, average time to the nearest emergency room (or perhaps limited to Level 1 trauma centers), average time from the nearest fire station, walk access to parks, and access to libraries. Another accessibility measure particularly recommended for consideration is the ratio of accessible jobs per person which has been linked to lower unemployment rates in a Tennessee study.

Second, several methodological improvements are recommended to the way the ITDM’s post-processor actually calculates accessibility measures. It is recommended that the tool use an all-streets network for calculating walk accessibilities and either GTFS or the ITDM’s transit networks for estimating transit accessibilities. Further, we recommend the use of a decay function to avoid cliff effects in accessibility calculations and account for uncertainty in travel time estimates including the variability of travel times from different points in a zone. An example decay function is shown in Figure 15.

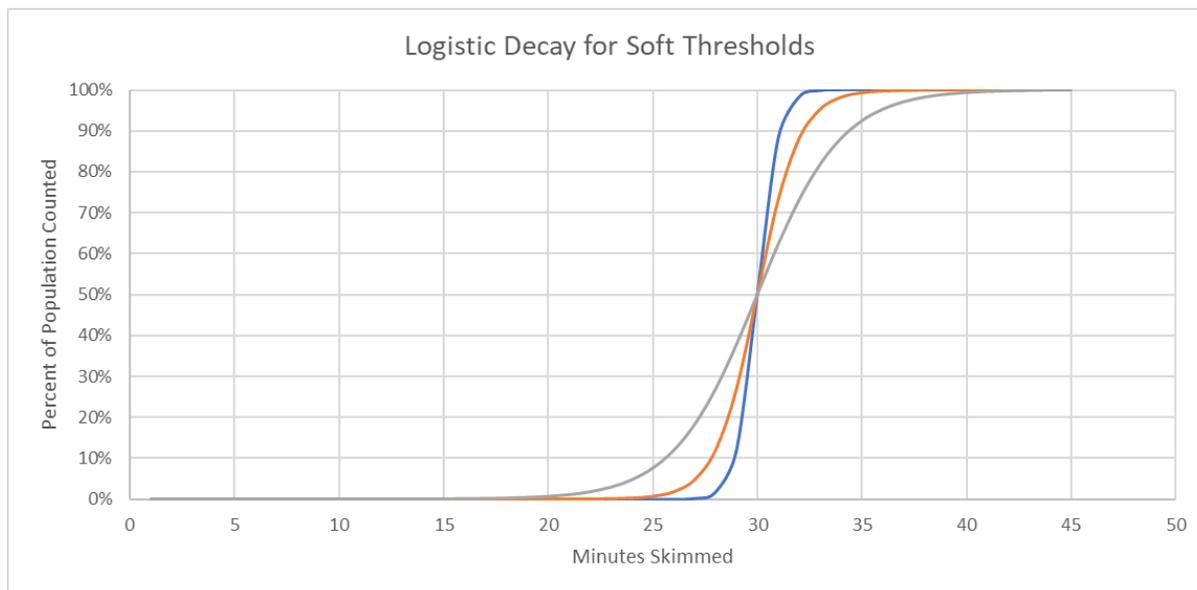


Figure 13. Example Decay Functions for Use in Calculating Accessibility Measures

Lastly, we recommend that the accessibility tool be enhanced to produce maps and charts in addition to the single number accessibility measures it currently produces. Maps can help illustrate what parts of the region lack accessibility to certain attractions, and how access varies spatially within the region. Charts can also help visualize not just a single, but a series of

accessibility thresholds for a more complete understanding of how accessibility varies across the population. An example accessibility map is shown in Figure 16.

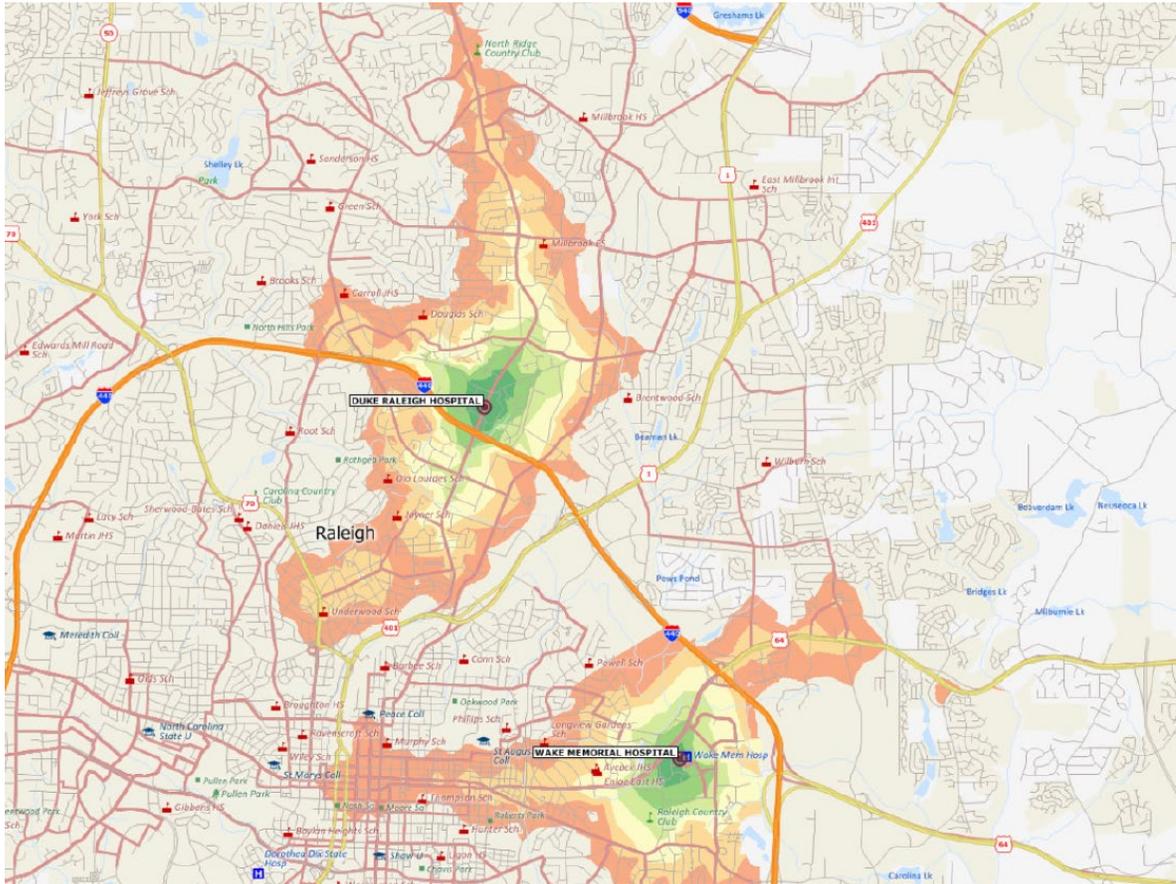


Figure 14. Example Map of Transit Accessibility to Hospitals in Raleigh, NC

Map Sharing Online

Another potentially useful functionality for the ITDM is the ability to publish maps online so that they be easily shared and accessed by a variety of stakeholders. Maps and other TransCAD visualizations could be shared privately via username and login or publicly with those given

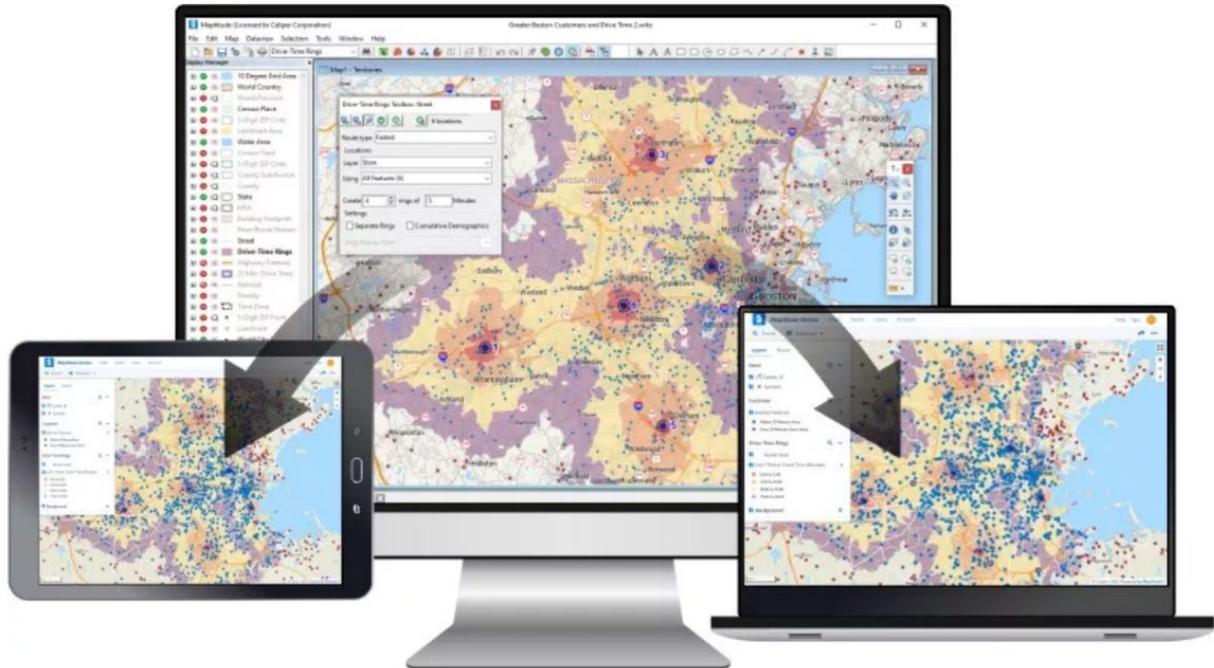


Figure 15. Caliper's Map-sharing Service

the map URL. Shared maps can be queried and formatted even by users without TransCAD. Hosting of the maps is a service, hence this functionality is structured as an annual subscription. It is tentatively recommended by the Data RoadMAP, pending available funding.

Socioeconomics Post-Processor

The Data RoadMAP recommends improving analytics related to socioeconomic distributional issues in several ways. The main ways this can be better analyzed is by tracking market segments of interest through the model and accounting for what portion of project or plan benefits accrue to them. However, these improvements still require definition of a single or small number of market segments of interest. In order to support custom analyses and query travel patterns for custom defined market segments, a further investment would be required, either in a full activity-based travel model (ABM) or a socioeconomic post-processor which produces disaggregate travel diaries for all members of the synthetic population similar to what an ABM produces. The development of such a post-processor would be less expensive than developing an ABM and would keep the runtime of the travel model more manageable, only requiring additional runtime when custom distributional analyses are required.

An socioeconomics post-processor for a hybrid trip-based model was developed and successfully used for equity analysis by TransLink, the Vancouver, BC, transportation planning agency. An equity post-processor of this sort for the ITDM would build on the disaggregate results of the initial components of the updated ITDM. From the synthetic population outputs, complete synthetic diaries for each member of the synthetic population

would be estimated by sampling from the aggregate destination and mode choice results from the ITDM. The sampling would be conditional on and constrained by prior sampling results to ensure logical, consistent daily travel patterns.

Since the main approach to distributional analysis recommended by the Data RoadMAP are the market segment tracking in the ITDM and benefit-cost analysis, the development of an additional post-processor of this sort is recommended tentatively given the availability of funding.

Recommendations for New IMPO Initiatives

This memo serves as an addendum to the IMPO’s Regional Data RoadMAP finalized in early 2023. That effort, in addition to examining the agency’s traditional travel-oriented data and analytical needs, also marked the first attempt to outline data and analytical needs related to the IMPO’s New Initiatives. These initiatives emerged from the 2018 Strategic Plan, which introduced a broader focus on economic development, land use and housing, and water resources.

At the time the *RoadMAP* was under development, the IMPO had already completed a major economic development plan (the *Comprehensive Economic Development Strategy* or CEDS); however, planning efforts related to housing and resiliency were only just beginning. The original document included guidance on how the IMPO might frame and develop a research agenda related to its New Initiatives, but with the planning efforts for housing and resiliency still underway—the *Central Indiana Housing Study* (CIHS) and the *Regional Resiliency Snapshot*, respectively—the agency determined it would be advisable to revisit its data and analytical needs for these initiatives after their completion.

This technical memo builds upon the foundation laid in 2023, incorporating findings and recommendations informed by these completed studies.

Revisiting Prior Findings and Recommendations

The *Regional Data RoadMAP* outlined early considerations for developing a research agenda related to the IMPO’s New Initiatives. Three foundational questions framed that effort:

- 1) How might the IMPO use its data and analytical capabilities with respect to these New Initiatives?
- 2) Who are the primary and secondary audiences for this work, and what is the value proposition of these expanded initiatives for IMPO members and partners?
- 3) Based on those audiences and objectives, what are the key thematic areas in which the IMPO envisions applying its data and analytical capacity?

To address the first question, the *RoadMAP* identified four primary applications, based on the IMPO’s experience in other domains and a review of peer organizations nationally:

- 1) Providing education pieces, story maps, and dashboards for stakeholders and the interested public;
- 2) Serving as a warehouse of regional data;
- 3) Monitoring regional progress on key performance indicators, planning goals, and performance measures, or similar metrics;
- 4) Serving as an analytical resource to local governments and/or stakeholder groups through providing customized, ad hoc research and/or aggregating public data for various purposes;

The IMPO already has processes in place for crafting education pieces, building dashboards, and warehousing data. The IMPO-led efforts resulting in the CEDS, the CIHS, and the *Regional Resiliency Snapshot* demonstrate early and ongoing efforts to extend the IMPO’s four pillars—Convene, Inform, Plan, and Fund—to its New Initiatives.

To support upcoming planning cycles, standardizing intervals between major planning efforts, and internal prioritization, Table 1 outlines the anticipated timeline and primary audiences for the next round of major planning efforts. These efforts represent key components of the IMPO’s New Initiatives and may help structure and align related activities over time.

Table 1. Select IMPO Planning Initiatives: 2026-2030

Select Initiatives	Key Partners	Audience(s)	Prepared by:	Anticipated Timeline
Central Indiana Housing Study (CIHS)	MIBOR, Indiana Realtors	<i>Primary:</i> LPAs/Mayors <i>Secondary:</i> general public, housing developers (for profit/nonprofit)	Consultant	2027-2028
Citizen Planner Training	APA-Indiana	<i>Primary:</i> Elected officials, planning commissioners <i>Secondary:</i> General public, LPAs	Consultant	ongoing
Community Preference Survey	MIBOR, Indiana Realtors	<i>Primary:</i> LPAs/Mayors, Realtors, housing developers <i>Secondary:</i> Media, housing organizations	Consultant	2026, 2030
Comprehensive Economic Development Strategy (CEDS)	CIRDA / Mayors, CICP, LEDOs	<i>Primary:</i> CIRDA/Mayors, CICP, LEDOs, EDA, LPA planning staff <i>Secondary:</i> General public	Consultant	2027
Contributions to Regional Housing Dashboard(s)	MIBOR, IN-Realtors, BAGI, CICF	<i>Primary:</i> LPAs/Mayors, Realtors, developers <i>Secondary:</i> General public	Staff	Annual
Preapproved Building Plans	LPAs, BAGI, housing developers	<i>Primary:</i> LPAs, housing developers <i>Secondary:</i> General public	Consultant	2026, ongoing
Regional Activity Centers Sub Area Plans	LPAs, MIBOR	<i>Primary:</i> LPA staff, IMPO transportation planning <i>Secondary:</i> General public, residential / commercial developers	Consultant	2027
Regional Development Tracker	LPAs, Visit Indy	<i>Primary:</i> LPA staff, IMPO transportation planning <i>Secondary:</i> General public, residential / commercial developers	Staff	2026 - ongoing
Regional Resiliency Snapshot	LPAs/Steering Committee	<i>Primary:</i> LPA staff, IMPO transportation planning <i>Secondary:</i> General public, residential / commercial developers	Consultant	2027-2028

Together, these efforts provide the foundation for a forward-looking agenda—one that anticipates future IMPO priorities, identifies relevant audiences and decision-makers, and considers the internal and external capacity needed to sustain this work.

In the sections that follow, this memo outlines anticipated updates to major studies such as the CIHS, CEDS, and Resiliency; introduces cross-cutting and topical data needs; and explores questions of staffing, consultant support, and resource allocation across the IMPO’s New Initiatives.

Staff Capacity: A Key Contextual Consideration

Housing, resiliency, and economic development fall within the IMPO’s planning and economic development sections, while data is a separate section within the IMPO staff structure. The major planning efforts associated with the New Initiatives have been supported by consultants who contributed to public engagement, research, and technical analysis—augmenting the IMPO’s internal capacity to shape regionally tailored strategies.

That model—relying on consultants—extends IMPO staff capacity, brings in technical expertise not always available internally or within Central Indiana, and may introduce insights from other markets. It can also provide an objective arbiter when local disagreements arise. At the same time, relying on consultants comes with costs and potential drawbacks: unless substantive and technical knowledge transfer occurs, an organization may continue to find itself relying on consultants rather than developing its own capacities. Hiring a consultant for a single purpose may limit the IMPO’s ability to purchase or license data products that could serve multiple uses.

While the IMPO acknowledges potential risks associated with consultant engagement—including variability in methodology, continuity, and cost—these can be mitigated through strong project scoping, documentation requirements, and clear expectations for knowledge transfer. When these practices are in place, they not only reduce project risk but also position IMPO staff to sustain consultant-developed products through recurring updates, provided that frameworks include clear instructions and accessible tools.

Given that the IMPO’s approach to engaging with its New Initiatives becoming more clearly defined through planning efforts, its path forward—particularly in determining when to utilize consultants versus relying on internally led efforts—is less clearly defined than its more established approach to traditional, transportation-focused analytical work. Because many of the datasets and platforms referenced in this memo require ongoing engagement to yield value, fully realizing their benefit will likely require a commitment of staff time—from either the data section or planning staff—to regularly access, analyze, and apply the information. In the absence of sufficient internal capacity to support that level of engagement, the IMPO may be best served by continuing to engage consultants, at least in the near term. This memo generally assumes that tasks already handled internally—or those closely aligned with existing functions—will continue to be staff-led; in other cases, consultant capacity will be assumed.

An Overview of Process and Organization of this Memo

The development of the following insights and recommendations included:

- a desktop review of the CEDS, the CIHS, the Regional Resiliency Snapshot, and other IMPO planning documents (e.g., *Unified Planning Work Program*, planning outlooks, etc.);
- meetings with staff to discuss the *RoadMAP* generally, and with staff responsible for research and analysis within each topical area; and
- outreach to vendors and data providers, including research on available data products and meetings with sales and technical teams from identified firms.

In addition to the topical areas covered in this memo, the IMPO also asked CityStrategies to conduct a cursory review of potential solutions related to Customer Relationship Management (CRM) platforms and resource management tools.

This memo organizes findings into sections corresponding to each topical area, organized with ‘cross-cutting’ resources at the beginning and ‘other’ resources at the end. Within each section, there is:

- a brief overview of the IMPO’s existing work in the area;
- a discussion of future data and analytical needs, along with potential solutions; and

- resulting recommendations.

The memo concludes with a summary and a table outlining anticipated outlays.

Cross-Cutting Resources

There are several data products that serve multiple purposes across the IMPO’s analytical work. For example, **Data Axle** (employment data) and **Woods & Poole Economics** forecast data are both recommended in the *Core Data/Employment* section in the *IMPO Regional Data RoadMAP*. While those resources are not listed for purchase here—so as not to double-count expenses—they may be useful in tracking progress and developing insights within economic development.

The IMPO’s **CommunityViz** model is recommended under Other Recommended Tools in the Data RoadMAP. CommunityViz supports scenario planning, enabling the IMPO to assess the various ways in which Central Indiana could grow and change over a 30-year planning horizon. Functionally, the tool uses future land use maps adopted by various entities within the region and applies different growth scenarios. A preferred scenario, identified through public and stakeholder feedback, informs the IMPO’s transportation modeling. While CommunityViz is primarily used to support the MTP update, it may also inform work related to the IMPO’s New Initiatives—particularly those focused on land use, housing, or economic development.

VisionEval is an open-source strategic modeling platform the IMPO will use to evaluate how policy decisions may affect long-range land use and transportation outcomes. The platform supports scenario-based analysis of travel behavior, emissions, energy use, and related impacts such as financial performance and quality of life. While VisionEval is primarily a transportation planning tool, it may yield insights relevant to the IMPO’s New Initiatives—particularly in areas where land use, economic development, or legislative changes intersect with travel patterns or environmental outcomes.

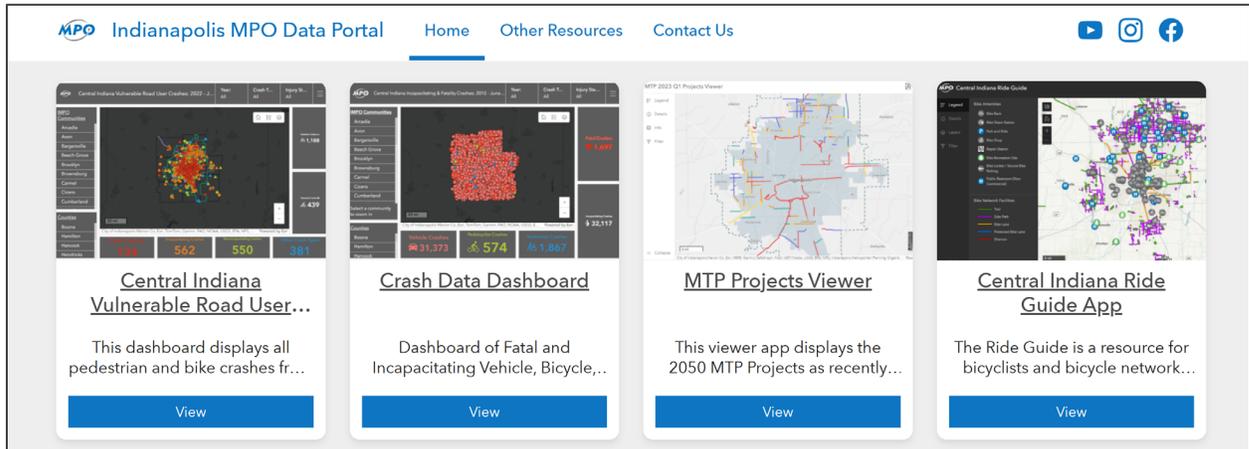
Recommendations

There are also tools that the IMPO currently uses across initiatives that are not listed elsewhere and thus included here.

ESRI: The IMPO has historically used **ESRI’s Community Analyst**—through its broader **ESRI ArcGIS Online License**—to generate socioeconomic reports for user-defined geographies. These reports support the IMPO’s regional performance measures. ArcGIS Online also powers several of the IMPO’s public-facing platforms, including map-based dashboards (e.g., Central Indiana crash data) and story maps (e.g., the Transit-Oriented Development Map Series and Dashboard).

In 2024, ESRI announced that Community Analyst would be deprecated due to becoming largely redundant with another ESRI product: Business Analyst. We recommend maintaining the current ArcGIS Online License and securing access to ESRI’s **ArcGIS Business Analyst Web App (Advanced)** for the duration of the plan.

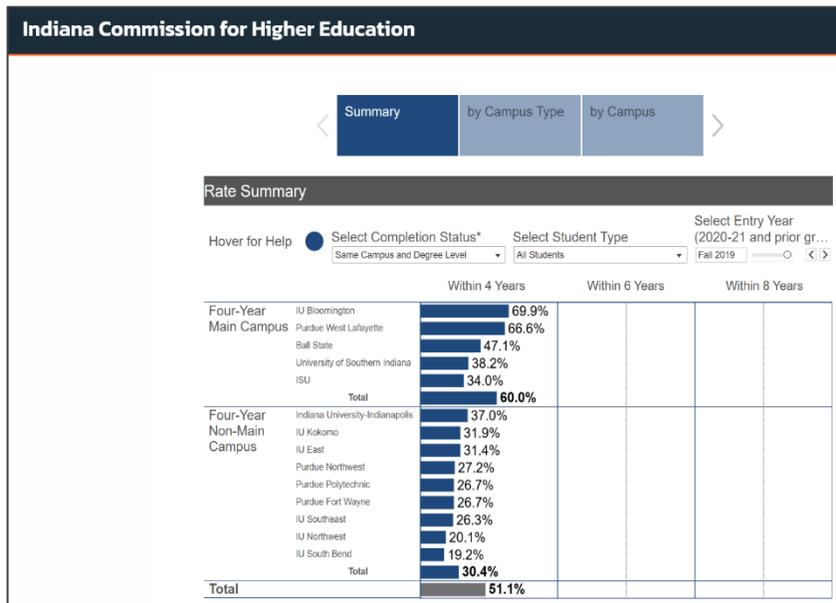
As part of the evaluation of products and services associated with this update, staff received a demonstration of **ESRI’s ArcHub Premium**. The IMPO currently accesses ArcHub features through its ArcGIS Online license to host maps and dashboards—such as the Central Indiana Crash Data dashboard, the MTP Projects Viewer, and the *Central Indiana Ride Guide*—and to warehouse data.



IMPO Data Portal, hosted on ERSI's ArcHub

ArcHub Premium builds upon this capacity by enabling the IMPO to craft interactive, map-based collaboration spaces that support coordination with LPAs, track activity across the region, and expand opportunities for public engagement. Staff have identified several potential use cases, including supporting the Land Use Panel, tracking new development, and facilitating the work of the Safety Action Plan Committee. Adoption may be worthwhile—provided the IMPO commits to fully leveraging these functions.

Tableau: The IMPO CEDS planning process included the development of a Tableau dashboard providing a snapshot of data compiled for the CEDS plan. The dashboard included several measures within five headings: Population & Demographics, Workforce Characteristics, Housing Characteristics, Industries & Occupations, and Startup Activities. This dashboard offers a potentially valuable framework for monitoring trends and generating insights related to regional economic development.



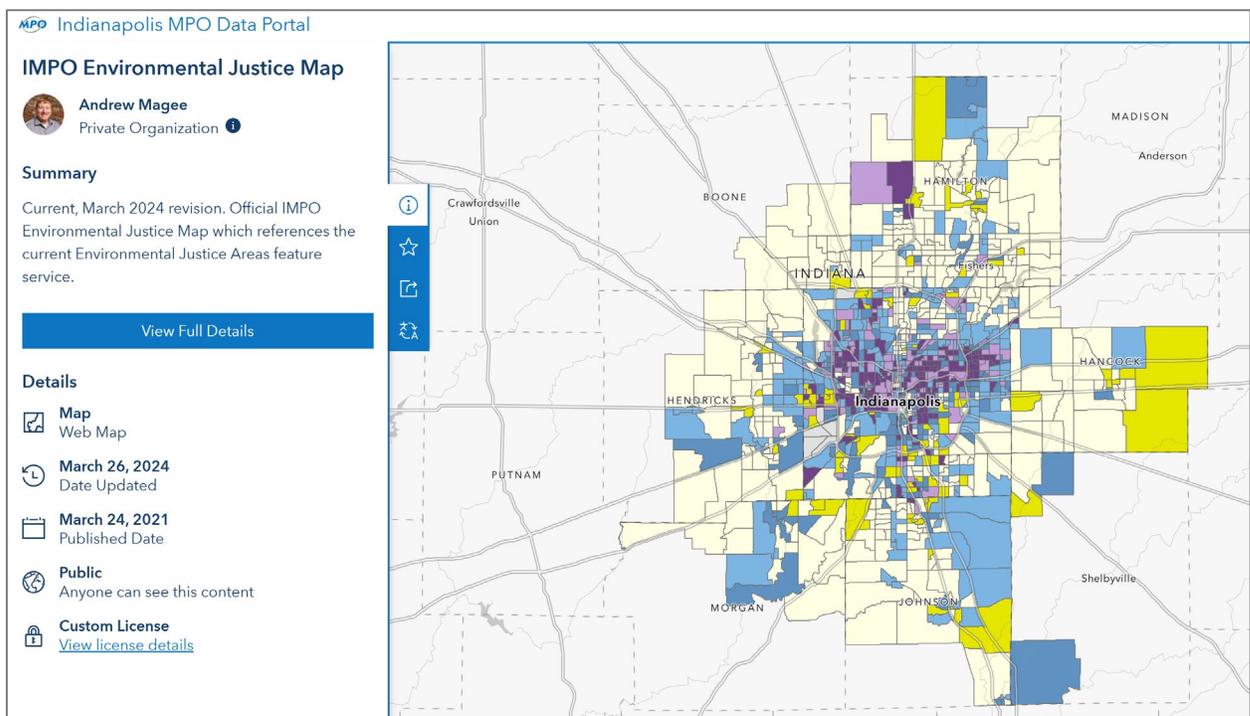
Indiana Commission for Higher Education College Completion Dashboard, hosted on Tableau.

Tableau Public is a free service that allows users to create, share, and explore data visualizations. Tableau dashboards can be populated with a variety of data that can be visualized in multiple formats; these visualizations can then be embedded into websites and allow users to filter or refine data views dynamically. For topic-specific dashboards that do not make use of the mapping functionality in ArcHub or ArcHub Premium (see example from the Indiana Commission for Higher Education), the IMPO may

want to consider using Tableau to populate and embed dashboards on its website.

The benefit of Tableau Public is that it is available at no direct cost to users; and while there are some limitations (e.g., limits on record count and data size, no automated updates, required cloud publishing, etc.), it is unlikely these limitations would curtail the IMPO’s most likely use cases for Tableau dashboards. Although Tableau Public is free to use, the IMPO would likely need to invest staff time and ensure sufficient capacity to develop, populate, and maintain dashboards embedded within its website.

This update to the *IMPO Regional Data RoadMAP* update recommends pursuing such an endeavor, particularly as it relates to economic development and housing data. Alternatively, the IMPO could identify a set of core metrics—similar to the inputs associated with its Environmental Justice Map—that are relevant across New Initiatives (e.g., demographics, income/poverty, housing characteristics, etc.). The IMPO could then commit to updating these core data with the release of each year’s update to the 5-year American Community Survey estimates.



IMPO Environmental Justice Map hosted on the Indianapolis MPO Data Portal.

In either application, there would be value in developing the capacity to embed these data into the IMPO’s website using Tableau, particularly when those data do not need to be mapped (e.g., in some applications, aggregate regional data, county-level data, and municipal data may be better visualized in chart/table form rather than maps).

MetroQuest: MetroQuest is an online engagement platform designed specifically for transportation planning. MetroQuest’s tool allows for the embedding of visual options within the survey platform, promoting interaction and more informed engagement, education, and potentially higher levels of participation among respondents. In recent years, the IMPO has used MetroQuest for its Transit Plan, comments on the MTP, and other planning and public engagement efforts.

This *Regional Data RoadMAP* recommends continuing to license MetroQuest in years when it is expected to support other IMPO initiatives; at present, the plan recommends its use in 2026 and 2027.

Citizen Planner Training: Throughout the planning period, the IMPO anticipates sponsoring a session of the *FUNDamentals for Citizen Planners (Basic)* training each year. This effort is designed to equip elected officials, plan commissioners, BZA members, and other local decision-makers with a foundational understanding of the planning process and peer practices. While not a data product, this recurring investment in capacity-building supports the effective interpretation and use of data and tools described in this *RoadMAP*. Over time, such training may also help foster more consistent and informed engagement across Central Indiana.

Parcel Boundary Data: This Regional Data RoadMAP does not include a formal recommendation to acquire enhanced parcel data but identifies it as an illustrative opportunity for future consideration. While the IMPO already accesses standardized parcel boundary data through statewide resources, commercially available datasets may offer additional value by providing expanded attributes—such as land use, zoning, valuation, and vacancy—in a consistent, cross-jurisdictional format. These enhancements could support a range of planning activities, including housing analyses, land use modeling, development monitoring, and land use components of efforts like Regional Activity Center Subarea Plans and Trail Oriented Development studies. Their uniform structure may also lend itself to integration into platforms such as ArcGIS and Tableau. If a future initiative indicates a clear need for more robust parcel-level data, options such as ReGrid or The Warren Group could be revisited for potential alignment with specific use cases.

Housing

The CIHS process began in early 2023 and concluded in early 2024. Building upon regional planning reports, local housing studies and other planning efforts, through public engagement, research, and analysis, the CIHS developed key findings and insights across five relatively distinct topical areas:

- **Socioeconomic Profile:** Relying primarily on American Community Survey data and other public or publicly-available sources, this effort developed insights into income disparities within the region, differences in demographic characteristics, migration patterns, concentrations of vulnerable populations, and related indicators.
- **Housing Market Condition:** Using a mix of public and proprietary data, this effort developed insights into development patterns and housing costs. Key findings included differences in development histories, patterns, and market conditions between the core and surrounding areas; temporal and geographic trends in multifamily development; trends in housing costs for single-family housing; and the emergence of purpose-built single family rental communities.
- **Housing Demand and Gap Analysis:** One of the more analytically intensive sections of the report, this section included a customized analysis of public and private data sources that sought to elicit insights into current housing demand (preferences by product type, size, and tenure) in comparison with existing supply. Then, using this understanding of the (mis)alignment of current supply and demand—along with

forecasted household growth and housing production—the analysis provided insights into projected gaps between supply and demand.

- **Contributing Factors Analysis:** This effort sought to identify underlying dynamics and trends that may be operating “behind the scenes” to shape housing access and attainability; these included considerations around transportation, costs of construction and housing finance, larger economic trends, and local regulation, among others. This section also included trends affecting vulnerable populations.
- **Corporate-Owned Single-Family Housing:** This section of the CIHS presented an advanced and proprietary statistical analysis estimating corporate and/or investor-owned single-family housing in Central Indiana.

Data in CIHS

The CIHS process made use of several sources of public and proprietary data, including those listed in Table 2. Any future updates building upon the initial CIHS will likely rely on the same, or comparable, data sources.

Table 2. Data Sources used in Central Indiana Housing Study (2023-24)

CIHS Public Data Sources	CIHS Proprietary Data Sources
Centers for Disease Control (Social Vulnerability Index) EPA Walkability Index Internal Revenue Service (Migration) MIBOR Market Insights Reports National Center for Education Statistics (school enrollment) State of Indiana (Judiciary) US Census: <ul style="list-style-type: none"> • American Community Survey: 5-year estimates (Summary Tables and Public Use Microdata Sample) • Building Permit Survey • Decennial Census • Historical Housing Unit and Urbanization Database • Longitudinal Employment / Household Dynamics (On the Map) • State of the Cities dataset 	CoStar ESRI Community Analyst The Warren Group Zillow

In considering data sources for future housing applications, there are tradeoffs between public and private data. Publicly available data sources for housing are fairly comprehensive; however, there is a delay between data collection and data availability. The housing market simply moves too quickly—in many cases—for publicly available data sources to accurately reflect current conditions. Public data may be well suited for insights into relatively static housing measures (tenure, age of structures, housing product mix); however, they may be less suitable for timely monitoring of changes in housing costs.

More timely data on home purchase prices is available via MIBOR and the State of Indiana’s Sales Disclosure Form (IN-SDF) data; however, there is no comparable public source available for rental data. Moreover, the MIBOR and/or IN-SDF data only capture the sales price of homes, they do not include other housing related costs (mortgage financing, taxes, homeowner’s insurance/private mortgage insurance, etc.) that are captured within American Community Survey data.

Alternatively, a number of proprietary datasets exist that may help address limitations of public data, particularly with regard to timeliness, geographic precision, or level of detail. Some products provide near real-time insights into multifamily market conditions, including rents, vacancy, and absorption, while others focus on single-family development patterns using aerial scans, transaction tracking, and detailed project status indicators. Additional offerings provide standardized parcel-level data compiled from assessor records, with attributes such as ownership, tax information, property use, and improvements—extending beyond the level of detail typically available from public sources. These datasets may also include modeled estimates of housing values or building permits and could have applications across housing, land use, and economic development analyses.

As noted above, the CIHS included resource-intensive analyses relating to housing demand/supply gaps and investor-owned properties. Those analyses make use of public and private datasets listed above (and perhaps others) along with proprietary methods of the consultants who contributed to the CIHS. These analyses may be more indicative of a one-off, add-on topical product that the IMPO could pursue to help inform regional dialogue at a particular point in time, as was done in the CIHS. Future efforts may revisit these topics—or explore others—as context and priorities evolve.

Current Housing Considerations

Staff recommend a complete update to the Central Indiana Housing Study (CIHS), occurring once every four to five years, as the centerpiece of the IMPO’s housing data efforts; the next CIHS is currently programmed for 2028. In addition to the CIHS, staff note the value in supporting a standardized snapshot of the region’s housing market, published on a recurring basis. While other organizations currently produce housing snapshots and market reports—focused on homebuying and development—the IMPO may be well positioned to contribute to a collaboratively produced product that more comprehensively reflects regional conditions. By bringing additional data—particularly timely data on the rental housing market—analytic capacity, and a regional perspective to the effort, the IMPO can help create a shared resource that could accompany and align with broader regional dashboard efforts. This would enhance public understanding and support local decision-making—advancing its core roles to convene and inform.

Beyond these regular updates, staff identified several topic areas that could be explored through follow-on analyses informed by the current CIHS or future iterations of the study. These include examining the relationship between housing and infrastructure needs across the region, identifying how different development typologies affect municipal fiscal sustainability, and applying these types of analysis in smaller geographies such as activity centers or trail-oriented development nodes. Additional opportunities may include aligning housing research with broader land use efforts—such as scenario planning using tools like CommunityViz and VisionEval—and supporting regional planning initiatives like the Regional Roundtable, the Regional Activity Centers analysis, and associated sub-area plans. By clarifying how housing patterns interact with infrastructure, land use, and regional growth strategies, this work can further the IMPO’s regional planning mission and directly support its roles in convening stakeholders, informing local decision-making, and advancing quality-of-life priorities across Central Indiana.

Housing Recommendations

The *IMPO Regional Data RoadMAP* recommended two housing-specific line items: the IMPO/MIBOR Community Preference Survey and a Regional Housing Indicators Update.

The **IMPO/MIBOR Community Preference Survey** examines factors that residents of Central Indiana consider important when making housing decisions, offers insights on their communities, and captures their perceived quality of life. The first iteration of this survey was conducted in 2012 with subsequent iterations conducted in 2018 and 2022. This effort has become a cornerstone of the IMPO’s efforts in housing (forming the basis for other efforts), represents a joint effort undertaken with a key community partner, and fills a unique void in the collective understanding of the housing market. We recommend the IMPO continue the Community Preference Survey with MIBOR and standardize the four-year interval, thus conducting the next survey in 2026 (or 2027 if desired to complete it nearer the CIHS update, below).

We recommend a comprehensive update to the **Central Indiana Housing Study**; the IMPO planning outlook currently programs this effort for adoption in 2028. This effort would update core data and analysis from the original CIHS while also creating space to explore new, analytically intensive questions shaped by future engagement or planning priorities.

This *Regional Data RoadMAP* recommends that the IMPO pursue a license for The Warren Group’s **Rental Data** to help fill a known gap in regional rental market information. By contributing timely, consistently structured data on rental price trends, supply and demand, affordability, and market segmentation, the IMPO can support a collaboratively produced housing snapshot or dashboard that complements existing efforts led by others in the region. The IMPO may also wish to explore The Warren Group’s **Automated Valuation Model (AVM)** dataset to assess its potential to supplement existing assessor and MLS data. Once licensed, these datasets should be evaluated for their potential utility across multiple IMPO initiatives.

As the market for housing and housing-adjacent data continues to evolve, there may be convergence or shifts in the offerings of various data providers. While this memo reflects the data environment as understood during its development, the IMPO should remain attentive to changes in vendor offerings and capabilities—particularly to avoid duplication, identify emerging tools, and ensure continued alignment with regional planning priorities.

The IMPO is also exploring the development of **Pre-Approved Building Plans** for traditional housing types. This initiative aims to help Central Indiana communities respond to housing challenges by reducing regulatory barriers to high-quality residential development. By offering design templates that can be deployed more quickly and efficiently without sacrificing quality, pre-approved plans can streamline local review processes and improve the pace and consistency of housing delivery. The initial investment in this effort is planned for 2026, with ongoing activity and associated costs anticipated annually thereafter. While not a data product, this strategy aligns with the IMPO’s role in supporting local capacity, simplifying implementation, and advancing regional housing affordability goals.

Economic Development

The next update to the Comprehensive Economic Development Strategy (CEDS) presents an opportunity for the IMPO to establish a more formalized approach to tracking regional economic trends and outcomes. One outcome of that process could be an economic development dashboard and/or summary product that draws on baseline measures—such as population, workforce, housing, industry, and innovation—as well as strategic action metrics aligned with regional goals. These outputs would be intended to contribute to a shared frame of reference for a broad set of audiences, including the Central Indiana Regional Development Authority, local elected officials, economic development organizations, the U.S. Economic Development Administration, LPA staff, and the general public.

A thoughtfully designed dashboard or annual report emerging from the CEDS process could help stakeholders monitor regional progress over time, support collaborative grant applications, and demonstrate alignment with goals and planning priorities. These products could also reinforce the IMPO’s roles in convening regional actors and informing local economic development strategies, particularly where those efforts intersect with housing, workforce, and transportation investments.



CENTRAL INDIANA CEDS REGION ECONOMIC EXPLORER

This Tableau workbook allows users to view data describing the economic health of the Central Indiana CEDS region (Boone, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, and Morgan counties) as well as state and national benchmarks through interactive charts and figures. Charts are arranged into categories based on the content.

HOW TO USE THIS WORKBOOK

Navigate to a topic by using the menu on the right or tabs at the bottom. Each chart has tooltips that are shown by hovering the mouse over a chart element. Series in a chart may be highlighted or emphasized by clicking on an element in the chart or in the corresponding legend. Many charts also have interactive filters in the form of drop-down menus or sliding bars to change which geographies, years, or other metrics are displayed. Each chart also has a "Return to Menu" button in the lower-right corner that returns to this page.

ABOUT THE DATA

Developed by TIP Strategies, Inc., for the Indianapolis Metropolitan Planning Organization. Sources include the US Census Bureau's 2019 American Community Survey (ACS) 5-year average sample, US Bureau of Labor Statistics, and Emsi. The US Census Bureau produces margin of error statistics (90% confidence intervals) for ACS measures. Users should exercise caution when using ACS estimates for small geographies, such as rural counties, as errors may be high.

KEY FINDINGS

POPULATION & DEM..	HOUSING CHARACTE..	
Population	Housing Cost	
Population Drivers	Homeowner Cost Distribut...	
Age	Affordability	
Race & Ethnicity	Occupancy	
Household Composition	Housing Stock	
Education	Connectivity	
Income	INDUSTRIES & OCCU..	
Poverty		County Sector Employment
Health Insurance Coverage		Regional Sector Employm...
Veterans	Regional Sector Distributi...	
People with Disabilities	Sector Trends	
WORKFORCE CHARA..	Sector Employment Chan...	
	Labor Force	Sector Location Quotients
	Labor Force Indicators	County Occupation Emplo...
Working from Home	Regional Occupation Empl...	
Commute Time	Occupation Trends	
Employment	Occupation Employment ...	
Employment Change from ...	Worker Flows by Occupati...	
Regional Employment Cha...	STARTUP ACTIVITY	
County Employment Chan...		Business Registrations
Employment Share by Co...		High Propensity Business ...

Central Indiana CEDS Region Economic Explorer (Tableau)

Current Economic Development Considerations

The IMPO’s economic development work includes both formal planning efforts—such as leading the region’s CEDS—and more ad hoc responsibilities, including data support for grant applications and local initiatives. Across these efforts, the IMPO contributes to a shared understanding of regional economic conditions by providing data, analysis, and coordination support.

1. **CEDS Update:** The IMPO is tentatively planning for a CEDS update to be adopted in 2027, with most planning efforts to occur in 2026. This consultant-led effort may be preceded by vision-setting activities that require early access to relevant data sources—particularly if consultant support is not yet in place. Throughout the planning process, data will inform the region’s economic development priorities and strategies. As part of the update, the selected consultant will likely be asked to develop a regional economic development dashboard. To support long-term utility, that work should be accompanied by clear documentation on data sources, methods, and a schedule or protocol for future updates.¹
2. **Supporting Grant Applications:** The IMPO is often asked by LPAs, local economic development organizations (LEDOs), and others engaged with local and regional economic development for data and related support for grant applications. While it can be difficult to anticipate the range of needs that may arise, data on transportation and commuting, vulnerable populations (which have historically been a key consideration in competitive federal grants), industry profiles, and employment are often useful.
3. **Tracking Development:** IMPO staff have initiated preliminary efforts to track development activity within the region and have had early internal discussions about how a more concerted effort—one that incorporates information provided by LPAs—might take shape. This ongoing effort is likely a lower priority than other tasks and would require the IMPO to dedicate staff time and access a platform through which activity could be tracked (such as ArcHub Premium). Nevertheless, the results could be useful in tracking, understanding, and forecasting growth, and the effort represents yet another way in which the IMPO can partner with LPAs.

Economic Development Recommendations

Data Sources: As part of this planning effort, we assessed both IMPLAN and Lightcast as potential data sources to support regional economic development analysis. While each offers utility for tracking economic and workforce conditions—and could inform future dashboards or economic impact analyses—we are no longer recommending that the IMPO directly license either product. Instead, we anticipate that the consultant selected to lead the upcoming CEDS update will access one or more of these (or similar) data sources as needed. As such, a separate IMPO subscription is not currently necessary.

Illustrative Survey Effort: The original *Regional Data RoadMAP* listed a *Survey of Businesses/Employers* as an illustrative project. Such an effort would be modeled on the IMPO/MIBOR Community Preference Survey in that it would be undertaken as a partnership with others and seek to identify insights that cannot be drawn from public and/or private data sources.

There are several examples of public/quasi-public entities surveying the business community for otherwise difficult to elicit insights into the economy. For example, the US Census Bureau conducts a national survey that seeks to identify perceptions around current business activities and assess perceptions around those businesses’ futures. The US Federal Reserve conducts an annual survey of businesses in which it seeks to develop insights into experiences and

¹The upcoming CEDS update is not included in the *Regional Data RoadMAP* budget estimate because it will require funding from sources other than federal planning (PL) funds.

anticipated needs for financing. The University of Michigan routinely measures consumer sentiment and produces its Consumer Sentiment Index to inform economic outlooks. The IMPO and its partners could seek to adapt one of these efforts to a local context, or pursue other insights that are difficult to draw from secondary data sources; business-owner outlooks around anticipated employment and employment needs or identifying trends around business formation and entrepreneurship may be topics that are rich for such additional exploration.

This survey effort remains illustrative for the purposes of this plan; however, such an effort – particularly if it could serve to strengthen existing community partnerships with other economic development entities—may prove useful. Such an exercise could serve as an input to the CEDS, or, alternatively, it could be a strategy that is committed to through an updated CEDS.

Conclusion: At this time, we do not recommend additional data purchases specific to economic development beyond what will be addressed within the scope of CEDS. The most immediate needs are expected to be addressed through a consultant-led CEDS update, which will likely generate a refreshed set of metrics and analytical tools. Beyond that effort, the IMPO’s role in coordinating with regional partners, identifying shared data needs, and fostering regional alignment across economic, transportation, and housing initiatives will remain central to advancing data-informed economic development strategies.

Resiliency

Of all the New Initiatives, the one perhaps most closely related to the IMPO’s traditional, transportation-oriented work is Resiliency. Similar to the CIHS, the *Regional Resiliency Snapshot* planning effort occurred throughout 2023 and 2024.

This effort sought to understand how prepared Central Indiana was to handle potential shocks and stressors arising from major natural or economic events, rising temperatures, and other concerns. Specifically, the *Regional Resiliency Snapshot* process yielded a Transportation Assessment that evaluated the potential risk to, and criticality of, transportation assets in relation to four potential threats: extreme heat, flooding, tornadoes, and winter/snowstorms. These threats were selected from a broader list of possible hazards based on their likelihood and potential impact.

Given these risks, the criticality of transportation assets—measured by their utilization (mobility and use), socioeconomic importance to surrounding populations, and connectivity to other assets—was also assessed. The intersection of risk and criticality resulted in a prioritization of transportation assets that should be considered for investment to improve the regional transportation system’s resiliency. Staff recommend updating the Transportation Assessment on a timeline that aligns with the next MTP update, ensuring that its findings are available to inform MTP project prioritization, while preserving Resiliency as a distinct planning activity.

Regional Resiliency Snapshot – Transportation Assessment: Data and Analysis

The Transportation Assessment is an analytically intensive effort, requiring the synthesis of multiple data sources and iterative work across software platforms (e.g., to and from Excel and ArcGIS). The effort makes use of national and state datasets related to potential threats and their associated risks, including data and tools from, at a minimum, Indiana University’s Environmental Resilience Institute, the Indiana Department of Natural Resources, the Federal

Emergency Management Agency, and the Environmental Protection Agency. To assess asset criticality, the analysis incorporates factors such as travel volumes (e.g., AADT), asset condition, population and employment density, the presence of vulnerable populations, and proximity to critical destinations.

The resulting relationship between risk and criticality is scored and plotted within a *Prioritization Matrix*, intended to guide local and regional decision-making on investment in transportation assets. Given the relationship between these priorities and the MTP, the IMPO may choose to prioritize assets identified as high-risk and high-criticality. As investments are made, other assets may be re-evaluated and considered for future prioritization. For this reason, the Transportation Assessment should serve as an input to the next update of the MTP.

The Transportation Assessment within the current Regional Resiliency Snapshot made use of state-based data sources when available but, in many cases, had to rely on federal data. A key challenge in blending datasets from different sources—with varying purviews, assumptions, and planning horizons—was the emergence of conflicting forecasts. These inconsistencies sometimes produced odd results, such as one dataset projecting a more severe near-term outcome than another projected for the long term. Given this uncertainty, along with the broader politicization of climate-related information and the complexity of interpreting risk and threat data, it is likely that data-related challenges will persist.

Given both the analytical intensity of the Transportation Assessment and the need for fluency in an evolving data environment, we recommend that the IMPO continue to engage a consulting team for future iterations of this work as part of upcoming Regional Resiliency Snapshots.

Regional Resiliency Snapshot: Other Applications

Other potential applications of the IMPO’s resiliency work could take multiple forms. At a minimum, staff identified a desire to make future efforts more actionable. Specifically, there was interest in ensuring the next planning effort yielded a “**Resiliency Toolkit**” or other actions that could be undertaken by LPAs when designing, building, or otherwise addressing transportation assets and the areas around them. Such an outcome could be included within a solicitation for the next *Regional Resiliency Snapshot* effort.

Relatedly, the IMPO already has a standardized process for a **Red Flag Investigation** (RFI), by which a quantitative analysis of infrastructure, water, hazardous materials, historical features, and other data within a half-mile of a proposed transportation project can be completed. The RFI relies on a repository of data that can be accessed by LPAs in investigating potential environmental features or issues near a proposed project. Staff discussed the potential for developing a similar approach for considerations relating to resiliency—an assessment about whether a potential project is significant from a resiliency standpoint. Similar to the toolkit idea above, adapting the concept of an RFI for resiliency considerations could be an outcome of the next *Regional Resiliency Snapshot*.

IMPO staff periodically field specific requests for data and information related to resiliency. Recent, illustrative requests include supporting (or supporting others’ pursuit of) grant applications in which specific environmental information is needed, exploring the relationship of greenhouse gases and buildings/projects, and providing imaging or ground coverage data (e.g., satellite imagery, land cover).

Given the regional nature of the IMPO, pursuing unique data sources with highly localized application may be unsuitable for its role in the region. Nevertheless, through its ongoing engagement with LPAs and others, and through the next update to the *Regional Resiliency Snapshot*, it is likely worthwhile to monitor those requests for recurring themes. Should such a need for similar data emerge from multiple stakeholders across the region, the IMPO may want to consider future data purchases, licensing, and/or research within that area. At present, this plan does not make a recommendation for any such data needs—only to monitor recurring themes.

Other

At a mid-study check-in, IMPO requested a cursory investigation of tools that could support stakeholder engagement and internal coordination. This included both a CRM system and resource management platforms. The CRM investigation focused on identifying cost-effective solutions to improve internal coordination and enhance public outreach. The resource management review sought strategies to better forecast staff capacity and reduce the likelihood of staff being scheduled beyond available capacity.

The IMPO had been relying exclusively on **Constant Contact** to manage email distribution lists, but limited licenses had created inefficiencies by concentrating responsibility for updates with a single staff member. Although IMPO staff had previously conducted a cursory review of CRM platforms, most available tools were either too robust or too costly for the IMPO’s intended use. Our review aligned with those concerns. While this plan initially did not recommend a specific CRM, the IMPO has since selected **Folk** for its CRM needs.

With human resource management, the IMPO strives to consider staff load when making annual plans, assigning work, and budgeting and allocating resources. The nature of the IMPO work, however, is that many planning processes, grant deadlines, and other external factors often drive the timing of when work actually occurs. Even with staff time being thoughtfully planned in advance, unanticipated circumstances—often driven by external factors or shifting schedules—can still lead to overextension.

To that end, we conducted a cursory investigation into resource management platforms—systems through which staff capacity and workload could be projected and monitored. The IMPO staff also connected us with its HR consultants to have access to their insights. One challenge associated with such platforms is that they can be challenging to set up and must become fully integrated into an organization’s workflows to be effective. Managing these platforms can add to the burdens of staff and reduce capacity; without a shared and sustained commitment to their use, the value of such platforms can be quickly undermined. In subsequent discussion with IMPO staff, it was determined the cursory investigation and conversation with the HR consultant was sufficient to move forward without a recommendation in this area.

Summary

Table 3 outlines estimated costs for all recommended expenditures from 2026 through 2030. These estimates are intended to support long-range planning and budgeting for data tools and analytical capacity in support of the IMPO’s New Initiatives.

The sources of these estimates draw on current and historical pricing for efforts and products with which the IMPO has direct experience, as well as preliminary pricing provided by vendors during our investigation of potential data and analytical solutions. For most annualized expenditures, we applied an assumed inflation rate of 3 percent per year and rounded to the nearest \$1,000.

As priorities evolve and partner needs shift, the IMPO should periodically revisit these investments to ensure continued relevance, cross-initiative coordination, and alignment with the IMPO's pillars: to convene, inform, plan, and fund.

Recommended Data, Modeling, and Analysis Budget

Figure 18 below presents an estimated budget for the recommended items discussed in this Data RoadMAP.

	2025	2026	2027	2028
Core Data				
OD, ADT, Bike & Ped Estimates	\$250,000	\$250,000	\$250,000	\$250,000
Travel Time Data	\$0	\$0	\$0	\$0
Employment Data	\$26,400	\$26,400	\$26,400	\$26,400
Safety Data	\$25,000	\$25,000	\$25,000	\$25,000
TIP Data Software	\$75,000	\$75,000	\$75,000	\$75,000
Travel Behavior Data				
Household Survey	\$973,470	\$179,512		
Synthetic Diaries		\$50,000		
Onboard Survey	\$50,000	\$250,000		
ATRI & Other Passive CV Data				\$300,000
Data/Analysis Studies				
Safety Studies		\$200,000		
Strategic Modeling	\$132,000			
Red Line After Study		\$200,000		
Blue Line Before Study	\$75,000			
Land Use Visioning	\$170,000			
Data MAP Update				\$100,000
New Initiatives				
ESRI AGOL License/Community Analysis	\$9,000	\$10,000	\$10,000	\$10,000
MPO/MIBOR Community Preference Survey		\$35,000		
Regional Housing Indicators Update	\$35,000		\$25,000	
Regional Resiliency Indicators Update & Dashboard		\$50,000		
Regional Employers Survey		\$35,000		
ATTOM Data	\$15,000		\$15,000	
Travel Model				
Basic Model Maintenance	\$35,000	\$35,000	\$35,000	\$35,000
Basic Model Update		\$175,000	\$50,000	
Master Network				
Speed Calibration				
Population Synthesis	\$25,000			
EJ Population Tracking			\$25,000	
Disag. Trip Generation		\$43,000		
WFH Module		\$27,500		
E-commerce Module		\$47,000		
Dynamic Segmentation		\$20,000	\$18,000	
Destination Choice Improvements		\$20,000	\$21,500	
Mode Choice Model Improvements		\$45,000	\$45,000	
Freight Model Update				\$75,000
Other Tools				
Benefit-Cost Analysis			\$150,000	\$100,000
Web Publishing	\$20,000	\$20,000	\$20,000	\$20,000
Socioeconomic Post-Processor				\$140,000
Total, basic recommendations	\$1,845,870	\$1,713,412	\$730,900	\$996,400
Total, with optional recommendations	\$1,915,870	\$1,818,412	\$790,900	\$1,156,400

Figure 16. Recommended Budget for Data, Modeling, & Analysis

Note: Costs associated with MPO/MIBOR Community Preference Survey and Regional Employers Survey assume the MPO's portion of a cost shared across multiple organizations.

Other Potential Future Investments

This section briefly discusses other potential investments that are not recommended to be budgeted through 2028, but which may be worthy investments at some point in the future.

Dynamic Traffic Assignment (DTA)

Dynamic traffic assignment (DTA) is a powerful tool that is seeing increasing use at the corridor level in support of corridor studies and facility design and operations. DTA models are much more realistic than the traffic assignment models found in MPO and statewide models as they treat the temporal nature of traffic directly and not simply in terms of aggregates over hourly or multiple-hour peak periods. DTA models also treat vehicle behavior and congestion in a more realistic fashion, making them suitable for operational analysis of system performance and traffic management strategies.

There are various types of DTA models that differ in the form of simulation upon which they rely. These simulation models may be mesoscopic or microscopic. Mesoscopic models are based on speed-density relationships while microscopic models move individual vehicles based upon physical factors of acceleration, deceleration, car-following, and lane changing. Microscopic simulation also treats traffic signals more realistically. For these reasons, DTA using microsimulation is to be preferred in our opinion. However, microsimulation is computationally demanding and may not be feasible for the widest areas. For this reason, we generally recommend that a hybrid approach be adopted in which part of the transportation network is simulated microscopically and the remainder is simulated mesoscopically where and when necessary.



Figure 17. A Fully Developed 3D Animation from a Regional DTA of Jacksonville, Florida

Instances of region-wide DTA remain limited, although some MPOs and DOTs have developed and are now maintaining such models. For example, the Michigan DOT developed

and maintains a TransModeler model of the SEMCOG region, and is using the model for various studies such as maintenance of traffic plans. The Nashville MPO, the Greater Nashville Regional Council, maintains a TransModeler model of the central part of their region and used it in a study of their Inner Loop. Regional DTA models have generally not replaced static assignment models in regional travel demand models, but rather served as a distinct tool or post-processor of the regional travel demand model. DTA makes it possible to evaluate a much wider variety of projects including traffic management and operations strategies that cannot be assessed with static traffic assignment models. A regional DTA model can also reduce costs and improve consistency and quality of future traffic simulation studies in the region. DTA models are also valuable in communicating with the public to explain projects and illustrate their benefits. Two-dimensional and 3D dynamic visualizations are part and parcel of successful DTA implementations. As such, they offer an opportunity to more inexpensively produce animations that better engage public involvement and stakeholder input than do the charts and figures of traditional modeling tools.

Connected/Autonomous Vehicle (CAV) Modeling Framework

While interest in and excitement about connected and autonomous vehicles has waned somewhat from its peak amidst the hype of several years ago, auto manufacturers continue to invest large sums of money in the development of this technology, and it is not unreasonable to think that it may well bear fruit within the planning horizon of upcoming MTPs. For this reason, some MPOs have added functionality to their regional travel demand models to allow exploratory modeling analysis (EMA) and scenario planning for CAVs.

As CAVs have the potential to impact all dimensions of travel, it is important that each of the model steps or components take proper account of their effects. The framework illustrated in Figure 20 was initially developed in support of the Michigan Department of Transportation’s statewide model, but has since been applied in statewide and metropolitan scale models in Michigan, Illinois, Virginia, Indiana (MACOG), and South Carolina. A framework for modeling CAVs can largely be thought of as an overlay on conventional mode travel models with the ability to adjust existing components and the addition of a few new components specifically related to the new phenomenon of zero occupant vehicle (ZOV) trips.

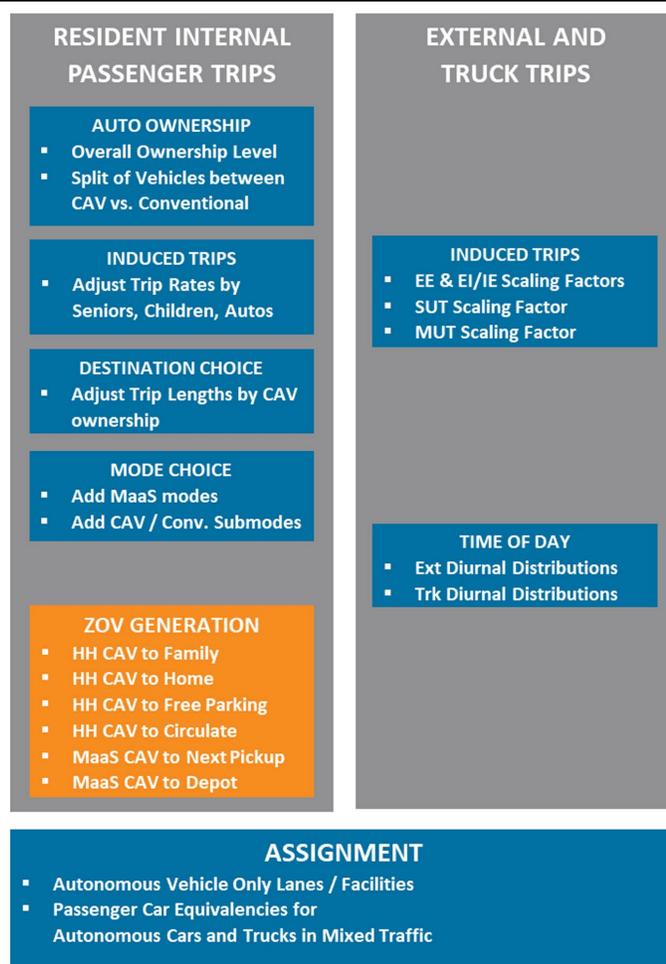


Figure 18. Framework for Modeling CAVs in Advanced Trip-based Models

As such, they offer an opportunity to more inexpensively produce animations that better engage public involvement and stakeholder input than do the charts and figures of traditional modeling tools.

The framework should address both privately owned CAVs (pCAVs) and shared CAVs (sCAVs) owned by TNCs, which offer mobility as a service. The user should be able to specify assumptions about how each dimension of travel may change for various market segments (e.g., induced trip-making and decreased sensitivity to in-vehicle time for households with their own private CAV). A CAV framework such as this should allow IMPO to test a wide range of possible CAV scenarios while there remains considerable uncertainty around them and then rapidly adjust travel assumptions as soon as substantial data on CAV use becomes available.