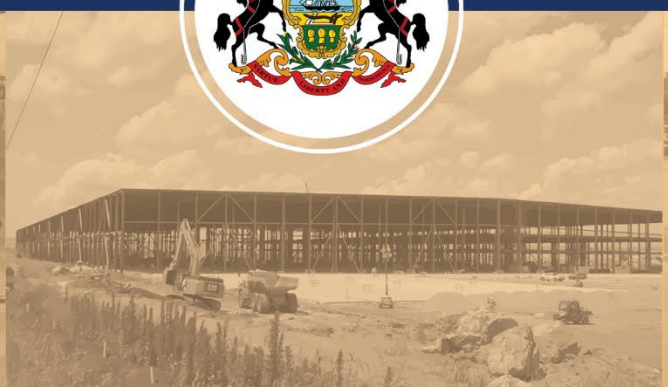
Transportation and Land Use Implications of

e-commerce

February 2025

PENNSYLVANIA TRANSPORTATION ADVISORY COMMITTEE



Executive Summary

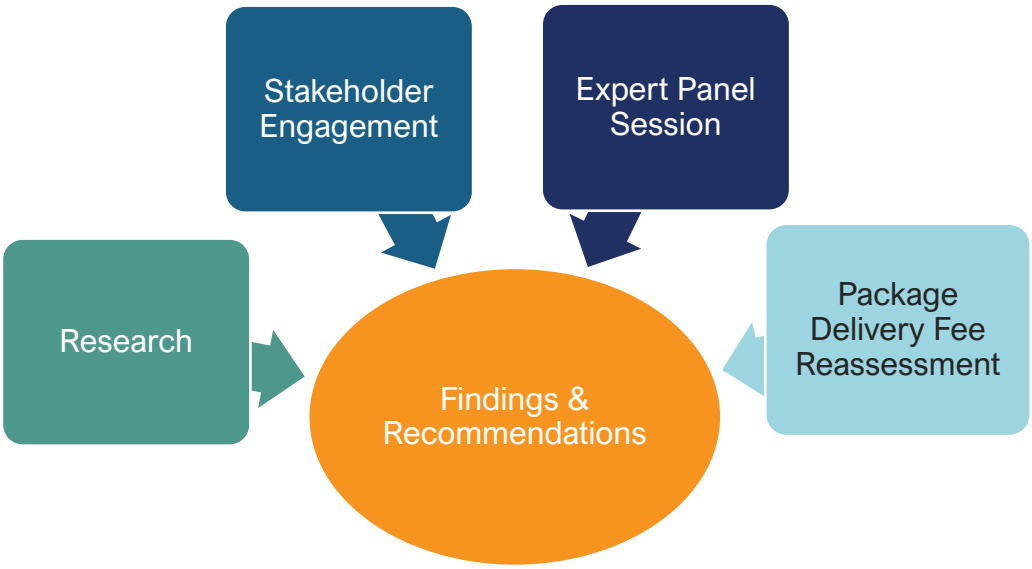
Why study e-commerce?

- Changes in how consumers obtain goods affect the transportation system—what type of traffic needs to be accommodated, where, and when, and what wear-and-tear that traffic causes. Changes may have safety implications as well.
- Similarly, the sustained trend of online ordering and home delivery of many goods that once involved a trip to downtown shops or a suburban mall shifts the demand for commercial real estate, and what type of development goes where (land use).
- Transportation and land use are closely interrelated and affect economic development and the quality of life in our communities; however, transportation and land use decisions are the responsibility of different entities.
- Much of the burden falls on local governments, which often lack the resources to guide e-commerce-related development in ways that maximize community benefits and minimize negative impacts, including traffic changes.

- This TAC study aims to:
  - Help PennDOT and its partners, including Pennsylvania's metropolitan planning organizations and rural planning organizations (MPOs/RPOs), **understand** the trends, issues, and opportunities associated with e-commerce.
  - Offer insight as to how PennDOT, its regional planning partners, and policymakers could **adapt** practices in light of shifts in transportation needs.
  - Encourage state, regional, and local governments—along with the private sector—to **collaborate** to address transportation and land use challenges and opportunities amid ever-changing technology and trends.

How was this study conducted?

- This study was led by a Task Force representing the public and private sectors, including the various levels of government and transportation modes.
- The study elements are depicted below:



No good options. To avoid blocking vehicle traffic on a busy Philadelphia street, this delivery vehicle stopped in the bicycle lane—despite the city's ordinance prohibiting such stops. The cyclist had to navigate into the vehicle travel lane and mix with motorized traffic. Such scenarios are commonplace in Pennsylvania's urban areas; the increase in e-commerce deliveries adds to the strain. Photo courtesy of Sam Arnold.

What are the study's findings?

Transportation Demand and Operations	
1	E-commerce trends, accelerated by the COVID-19 pandemic, have altered transportation demand in ways that need to be better understood.
2	E-commerce seems to have a disproportionate impact on the local transportation system, while its overall impact on transportation across a regional scale appears to be minimal.
3	E-commerce has implications for street operations and design, including in dense urban centers (e.g., double parking with congestion and safety risks).
4	Few of the state's MPOs and RPOs have conducted specific studies or analyses related to e-commerce; however, many have regional freight plans and continue to monitor e-commerce.
5	E-commerce facilities will likely require expanded public transportation access for workers.
Employment and Economic Development	
6	E-commerce generates substantial employment and economic benefits that need to be considered for balanced public policy affecting the industry.
7	Warehousing and fulfillment center employment generally yields a greater economic benefit to regions than traditional retail employment.
8	Major e-commerce companies pose competitive challenges for traditional small businesses and downtown vitality.
Land Use	
9	E-commerce has contributed to the decline of traditional retailing, the repurposing of malls and shopping centers, and increased development of fulfillment centers.
10	Planning and zoning need to be modernized through a proactive, collaborative approach among public and private stakeholders.
11	State government can provide general guidance and direction for local communities to plan for e-commerce facilities.
Technology	
12	Lack of reliable broadband Internet access limits participation in e-commerce by small businesses and potential consumers in many rural areas.
13	E-commerce is driving technological innovations.

14	It is unknown how autonomous vehicles, personal delivery devices, and other vehicle technologies will impact the transportation system in terms of goods movement as technology advances and e-commerce grows.
Data Needs	
15	The distinctions between traditional retail commerce and e-commerce are difficult to identify and measure, yet important to differentiate.
16	Quantifying the various impacts and benefits of e-commerce would be a useful future assessment to help decision-makers and transportation professionals.
Revenue	
17	The package delivery fee proposed by the 2021 Pennsylvania Transportation Revenue Options Commission (TROC) is a potential revenue source, yet is not a comprehensive solution to the pressing transportation funding problem.

What are the recommendations?

Transportation Planning, Infrastructure, and Services	
A	Policymakers should consider a package delivery fee to fund needed transportation infrastructure improvements.
B	Work with MPO/RPO regions to develop regional freight plans that include intermodal strategies for goods movement and emerging e-commerce considerations at a local level.
C	Address the public transportation needs for e-commerce workforce access.
D	Develop a needs assessment for e-commerce related to transportation infrastructure (particularly for the local network).
Land Use and Local Government Support	
E	Develop and promote the use of an e-commerce planning and development guidance handbook.
F	Municipalities should amend zoning regulations, including incorporating loading zones into any new developments.
Public-Private Sector Collaboration	
G	Pursue ongoing relationships with e-commerce providers, including engagement in appropriate forums.
H	Incorporate e-commerce as part of the statewide emphasis on truck parking accommodation and staging areas, including related public–private coordination.
I	Work with e-commerce retailers and industrial developers to identify opportunities for new e-commerce development in town centers to support existing and new business establishments.
J	Explore locating e-commerce fulfillment centers on airport properties (which typically have available land, road access, and revenue challenges).
Data Collection and Analysis	
K	Implement post-development traffic data collection programs for industrial sites to quantify the changing characteristics of site operations and deliveries as e-commerce continues to evolve.
L	Analyze the impact of brick-and-mortar losses on various tax revenue streams in relation to e-commerce tax revenue gains.
M	Develop capabilities and tools for economic analysis for transportation planning.
N	Produce a quantitative analysis of the various impacts and benefits of e-commerce.

Contents

Letter from the Chair

The Transportation Advisory Committee (TAC) recognizes the impacts of e-commerce as dynamic, transformative, and warranting a greater understanding. Because public officials must understand the issues and opportunities associated with this business model, the TAC chose to examine e-commerce in relation to transportation and land use throughout the Commonwealth.

We commend the work of the study task force in addressing this complex subject. In many respects, it is uncharted territory. The study will have value for the General Assembly, PennDOT, other state agencies, regional organizations, and local governments (all of which contributed their perspectives on the topic).

The extent of stakeholder engagement was noteworthy, including a virtual expert panel session with five panelists and more than 180 participants, a survey of the state's planning partners (metropolitan planning organizations and rural planning organizations), and research on package delivery fees in Washington State, Minnesota, and Colorado.

The report is primarily educational through its research and findings, and offers some recommendations. While there are public costs and community impacts associated with the growth of e-commerce, such as those associated with the use of state and local roads, there are also significant benefits—particularly jobs in the transportation and warehousing sector that typically pay higher wages than retail jobs—and an expansion of state and local tax revenues.

This study should be seen as a start that promotes discussion and strategy among state and local government and private-sector stakeholders. That collaboration must be aimed at ensuring that transportation infrastructure and local land use can help to achieve the benefits of e-commerce while also considering how to reasonably address the costs.

As noted, several states have enacted or are considering package delivery fees to address the costs of e-commerce. While a package delivery fee is not a panacea for Pennsylvania's extensive unfunded transportation needs, there is merit in considering that mechanism as part of a comprehensive approach to transportation investment. This work is timely in that regard.

We appreciate your interest in this important topic and the work of TAC.

Jody L. Holton, AICP, Chair
Transportation Advisory Committee

Sam Arnold, Chair
Study Task Force

Background

Pennsylvania's Transportation Advisory Committee

The Pennsylvania Transportation Advisory Committee (TAC) was established in 1970 by Act 120 of the State Legislature, which also created the Pennsylvania Department of Transportation (PennDOT).

TAC has two primary duties. First, it "consults with and advises the State Transportation Commission and the Secretary of Transportation on behalf of all transportation modes in the Commonwealth." In fulfilling this task, TAC assists the Commission and the Secretary "in the determination of goals and the allocation of available resources among and between the alternate modes in the planning, development, and maintenance of programs, and technologies for transportation systems." TAC's second duty is "to advise the several modes [about] the planning, programs, and goals of the Department and the State Transportation Commission."

TAC undertakes in-depth studies on important issues and serves as a liaison between PennDOT and the public. TAC consists of the following members: the Secretary of Transportation; the heads (or their designees) of the Department of Agriculture, the Department of Education, the Department of Community and Economic Development, the Public Utility Commission, the Department of Environmental Protection, and the Governor's Policy Office; two members of the State House of Representatives; two members of the State Senate; and 18 public members—six appointed by the Governor, six appointed by the President Pro Tempore of the Senate, and six appointed by the Speaker of the House of Representatives.

Acknowledgments

Transportation Advisory Committee

The Honorable Jody L. Holton, AICP, Chair
Assistant General Manager
SEPTA

The Honorable Mark Murawski, Vice Chair
Transportation Planner
Lycoming County

The Honorable Wayne Langerholc, Jr.
Senate of Pennsylvania
Majority Chair of Senate Transportation Committee
Alt: Nolan R. Ritchie

The Honorable Timothy P. Kearney
Senate of Pennsylvania
Transportation Committee
Alt: Sam Arnold

The Honorable Ed Neilson
Pennsylvania House of Representatives
Majority Chair of House Transportation Committee
Alt: Kyle Wagonseller

The Honorable Kerry Benninghoff
Pennsylvania House of Representatives
Minority Chair of House Transportation Committee
Alt: Josiah Shelly

The Honorable Mike Carroll
Secretary
Pennsylvania Department of Transportation

The Honorable Stephen M. DeFrank
Chair
Pennsylvania Public Utility Commission

The Honorable Akbar Hossain
Secretary of Planning and Policy
Office of the Governor

The Honorable Angela Fitterer
Interim Acting Secretary
Pennsylvania Department of Education

The Honorable Russell Redding
Secretary
Pennsylvania Department of Agriculture

The Honorable Jessica Shirley
Acting Secretary
Pennsylvania Department of Environmental Protection

The Honorable Rick Siger
Secretary
Pennsylvania Department of Community and Economic Development

Mr. Richard Barcaskey
Executive Director
Constructors Association of Western Pennsylvania
Allegheny County

Mr. Alan Blahovec, CCTM
Executive Director
Westmoreland County Transit Authority
Westmoreland County

Mr. Michael Carroll, P.E.
Office of Transportation and Infrastructure Systems
City of Philadelphia

Ms. Felicia Dell, AICP
Director
York County Planning Commission (retired)

Mr. Donald L. Detwiler
New Enterprise Stone and Lime Co., Inc.
Bedford County

Mr. Elam Herr
Pennsylvania State Association of Township Supervisors (retired)
Lancaster County

Mr. Jeffrey Letwin
Saul Ewing, LLC
Allegheny County

Mr. Jeff Mercadante
Pitt Ohio
Allegheny County

Larry J. Nulton, Ph.D.
Nulton Aviation Services, Inc.
Cambria County

Ms. Rebecca Oyler
President & CEO
Pennsylvania Motor Truck Association
Cumberland County

Mr. John Pocius, P.E., PLS
LaBella Associates
Lackawanna County

Mr. L. Ashley Porter, P.E.
Porter Consulting Engineers, P.C.
Crawford County

Mr. Jeffrey J. Stroehmann
JDM Consultants
Union County

Mr. Ron G. Wagenmann
Manager
Upper Merion Township (retired)
Montgomery County

Mr. Charles F. Welker, P.E.
EADS Group, Inc. (retired)
Blair County

Study Task Force

Mr. Sam Arnold, Chairman
Policy Director
Pennsylvania Senator Tim Kearney's Office

Johanna Amaya, Ph.D.
Center for Supply Chain Research,
Smeal College of Business
The Pennsylvania State University

Mr. Alan Blahovec, CCTM
Executive Director
Westmoreland County Transit Authority
Westmoreland County

Ms. Felicia Dell, AICP
Director
York County Planning Commission (retired)

Mr. Anthony McCloskey, P.E.
Director
PennDOT Bureau of Aviation

Ms. Rebecca Oyler
President & CEO
Pennsylvania Motor Truck Association

Mr. John Pocius, P.E., PLS
LaBella Associates

Mr. Christopher Puchalsky
City of Philadelphia

Mr. Shane Rice
Policy Director
PennDOT

Mr. Dave Vitali
Public Policy Manager
Amazon

Mr. Nathan Walker
Office of Planning
PennDOT

Mr. Dennis Walsh
President, Government Relations
The Bravo Group

Lina Wang, Ph.D.
Center for Supply Chain Research,
Smeal College of Business
The Pennsylvania State University

Mr. Jeffrey Young
William & Hannah Penn Fellow
PennDOT Policy Office

Acronyms

B2B .....Business-to-business

B2C .....Business-to-consumer

DCED.....Pennsylvania Department of Community and Economic Development

DVRPC .....Delaware Valley Regional Planning Commission

EJ.....Environmental justice

EPA .....U.S. Environmental Protection Agency

EV .....Electric vehicle

FY .....Fiscal year

HOP.....Highway Occupancy Permit

IIJA/BIL.....Infrastructure Investment and Jobs Act/Bipartisan Infrastructure Law

ITE .....Institute of Transportation Engineers

L&I.....Pennsylvania Department of Labor and Industry

LEHD.....Longitudinal Employer-Household Dynamics

LEP .....Limited English Proficiency

MPC .....Municipalities Planning Code

MPO.....Metropolitan Planning Organization

NEPA .....Northeastern Pennsylvania Alliance

NAICS.....North American Industry Classification System

PPA.....Pennsylvania Planning Association

PennDOT .....Pennsylvania Department of Transportation

PSATS.....Pennsylvania State Association of Township Supervisors

RPO.....Rural Planning Organization

STC .....State Transportation Commission

TAC.....Transportation Advisory Committee

TMA.....Transportation management association

TRB.....Transportation Research Board

TROC.....2021 Pennsylvania Transportation Revenue Options Commission

VMT.....Vehicle-miles traveled

Glossary of Terms

The following defines key terms as they are used in this report.

E-commerce – Generally refers to the industry sector involving electronic interfaces between businesses engaged in retail sales and services customers.

E-commerce development or facilities – Refers to the footprint for accommodating e-commerce, including buildings, land, roads, etc.

Fulfillment center – Refers to the type of facility in which e-commerce orders are handled for shipping.

Omnichannel – Refers to an integrated approach to product sales, support and service across multiple marketing and customer service channels. These channels typically include a blend of online, in-person, and mobile operations to provide a coordinated and personalized brand experience for customers.

Defining ‘E-Commerce’

Electronic commerce, or “e-commerce,” is defined as the buying and selling of goods and services through electronic interfaces such as computers, smartphones, and other devices. It is distinguishable from traditional retail commerce in that it eliminates the need for consumers to engage directly with a local store or other retail establishment to transact the purchase and obtain the desired product or service. In that sense, the transportation and land use aspects of modern e-commerce are comparable to those of the mail-order catalog industry of prior generations—but to a much greater degree.

Modern e-commerce includes distinct market segments defined by the buyer and seller type in any given transaction. These include business-to-business, business-to-consumer, consumer-to-consumer, and consumer-to-business. These various types of transactions are often described through acronyms such as B2B (business-to-business), B2C (business-to-consumer), etc. The overall approach and nomenclature of this study addresses e-commerce in a business-to-consumer (B2C) context, including the delivery of a wide range of products and restaurant deliveries. The findings and recommendations apply to the full spectrum of e-commerce activity.

E-commerce also includes online sales of digital services and products, such as the use of software, social media sites, streaming services, music subscription services, graphic design services, videoconferencing, and many other digital tools. However, this study specifically refers to e-commerce as it relates to the sale and delivery of tangible personal property—physical goods purchased online at retail sites and delivered to the customer’s location.

Common characteristics and benefits of e-commerce trade and industry operations include the following:

- A diminished reliance on traditional “brick-and-mortar” retail stores for purchases of merchandise.
- A transition from consolidated distribution operations in a supply chain with traditional warehousing, storage, and distribution to “fulfillment center” operations where merchandise is handled for direct deliveries to customers rather than bulk shipments to retail stores.
- Expanded geographical reach for companies engaged in e-commerce using less expensive and more efficient distribution processes compared to traditional warehousing and brick-and-mortar stores.
- Reduced barriers to entry for new businesses in the marketplace, due to the lower cost of digital infrastructure as compared to physical storefronts and storage/handling facilities.

From the standpoint of transportation and land use, the primary characteristic of e-commerce is the direct contact between the customer and the retailer without a physical store as an intermediary. This is illustrated in Figure 1, which depicts the supply chain for traditional retail sales vs. e-commerce, and Figure 2, which depicts travel demand for traditional retail sales vs. e-commerce.

As shown in Figure 1, with traditional retail, customers only interact with the retailer at a physical store. The retailer's supply chain network is set up accordingly. There is no interaction between customers and the warehouses or vendors. The supply chain network is more straightforward and there are fewer transportation movements between the supplier, wholesaler, and retailer before the merchandise reaches the customer.

The bottom portion of Figure 1 depicts a typical supply chain network for an e-commerce company. Customers interact with the e-commerce retailer at multiple points in the supply chain, including the warehouses, fulfilment centers, and even directly with the vendors producing the merchandise. The "customer touch points" are shown as two-way interactions due to the high volume of returns handled in an e-commerce network.

Figure 2 compares travel demand or trip-making under a traditional retail model to trips made under an e-commerce model. With traditional retail, bulk delivery is made from the warehouse to the retail store. Each household or business makes a two-way trip to the store and back for purchases, which results in intensive activity at the retail establishment.

The bottom portion of Figure 2 shows the relative efficiency of customer delivery with e-commerce. One delivery vehicle on a looped route can replace bulk delivery to the store and numerous individual trips by shoppers. Specialized deliveries are also made on a customer-by-customer basis via individual truck or van trips. The retail store has no role in most e-commerce transactions.

While the operating practices of e-commerce businesses vary widely, a general observation for most of these companies is that their contribution to freight transportation activity primarily involves new methods of processing orders, handling freight, and making deliveries. This does not necessarily mean e-commerce has resulted in the generation more freight activity than a region would see if all products were sold and delivered to customers through the traditional retail model. A 2019 Stanford University policy briefing on the economic impact of e-commerce for the period from 2007 to 2017 indicated that the overall economic benefit of e-commerce was approximately a 1 percent increase in consumption through extra buying power per U.S. household by making purchases online.[1] Transportation impacts are primarily seen at a localized level at e-commerce facilities and in city and town centers where deliveries are more likely to affect street operations in a dense urban environment.

[1] Klenow, Pete, "How Valuable is E-Commerce?" Stanford Institute for Economic Policy Research (SIEPR), August 2019, https://siepr.stanford.edu/publications/policy-brief/how-valuable-e-commerce

Figure 1: E-Commerce Changes to the Supply Chain

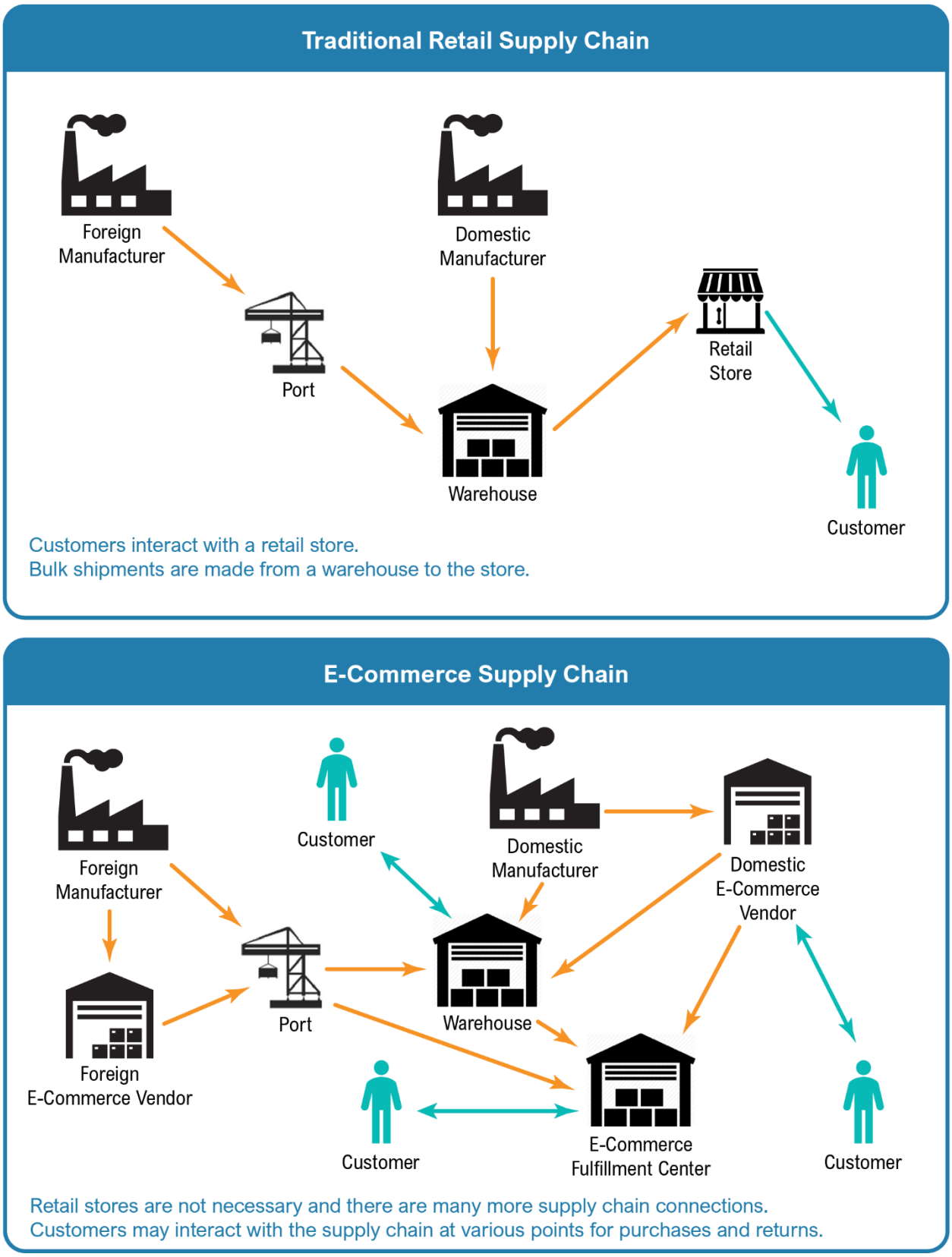
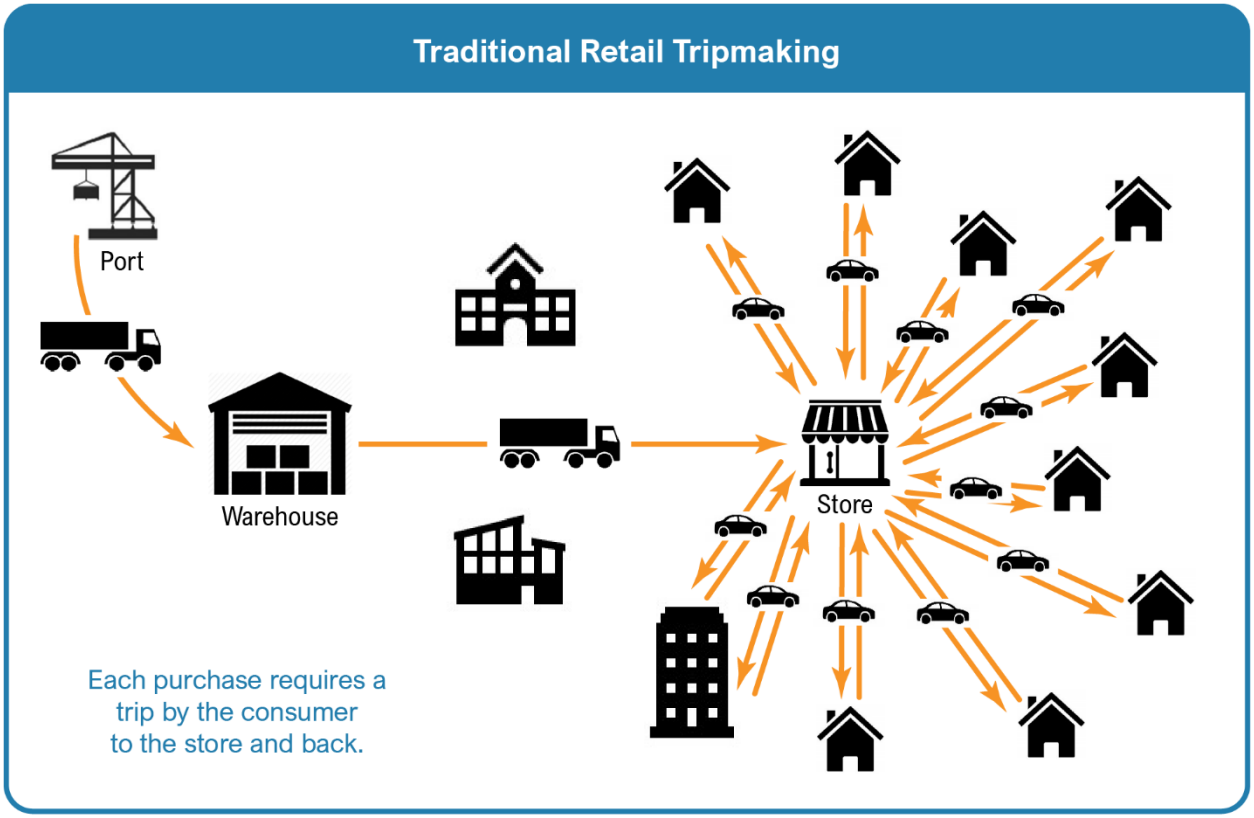


Figure 2: E-Commerce Changes in Travel Demand



In addition to shifts in transportation demand, e-commerce has led to significant land use changes, most notably the decline of retail shopping centers and the development of e-commerce fulfillment centers. Those issues are discussed in the land use chapter.

In summary, e-commerce offers many benefits for customers and communities, and also introduces some concerns. They are summarized in Figure 3 and discussed throughout this study.

Figure 3: Overview of E-Commerce Benefits and Costs

Benefits	Costs
▶ Higher-paying jobs than traditional retail ▶ Cost-effective global reach for businesses ▶ State and local revenue through property tax and income tax ▶ Consumer convenience; delivery options ▶ Economies of scale for last-mile deliveries (fewer customer trips)	▶ Localized congestion ▶ Safety ▶ Local transportation infrastructure maintenance ▶ Displacement of traditional retail employment sectors ▶ Community aesthetics and quality of life

Sign of the times. Sears was the nation's leading retailer for more than 100 years—first as an innovative mail-order company providing essential goods to rural America, and later in the 20th century as a ubiquitous department store in suburban malls. Even so, it became a casualty of changing consumer behavior, filing for bankruptcy in 2018. Most of its retail stores, such as this one in DuBois, are vacant, surrounded by vast, empty parking lots.

Study Purpose and Methodology

Study Purpose and Focus

TAC undertook this study to:

- Document and analyze e-commerce impacts on transportation operations and infrastructure.
- Identify the land use implications of the growth of e-commerce.
- Review economic influences and some tangible benefits associated with e-commerce.
- Explore transportation funding implications associated with e-commerce, specifically package delivery fees as proposed in the 2021 Pennsylvania Transportation Revenue Options Commission (TROC) report and since implemented by other states.

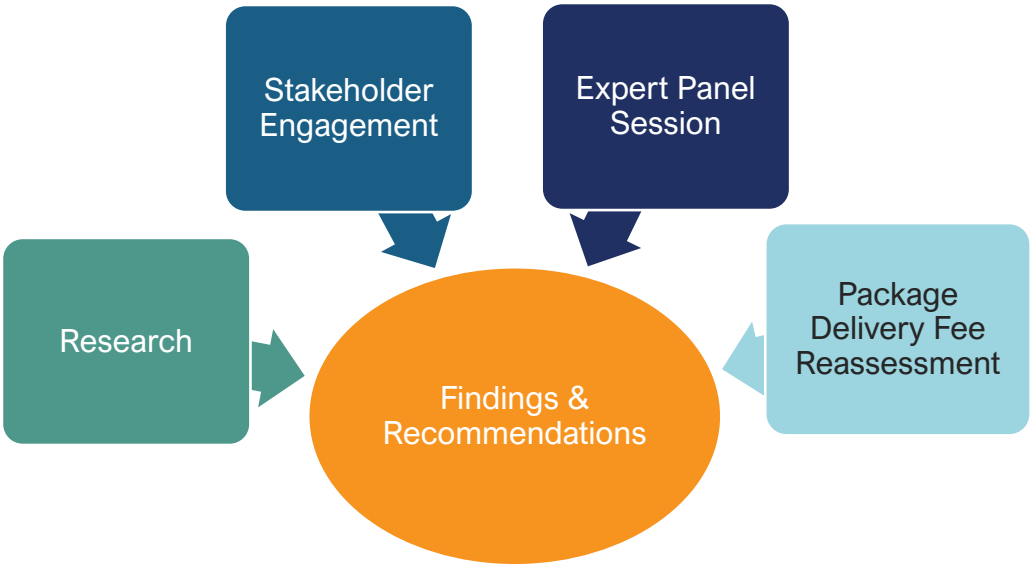
This study focuses on e-commerce as it relates to transportation and land use. Transportation and land use are largely within the domain of PennDOT and local government, respectively. PennDOT has direct operation of the state transportation system of nearly 40,000 miles of roads and 25,543 bridges, while Pennsylvania's more than 2,500 municipalities own and operate local systems of nearly 79,000 miles of roads and 6,685 bridges greater than 20 feet in length. Local government is also responsible for land use decisions that often impact transportation, and vice versa.

E-commerce affects all modes and sectors to some degree, including private-sector entities such as delivery companies and airlines. PennDOT's broad oversight (as contrasted with operation) of the state's entire transportation network means that findings may span modes and sectors as appropriate from a state policy, oversight, and stewardship perspective. The TAC generally restricts the recommendations of its studies to the areas where PennDOT can exercise positive influence directly and/or as a partner with the various modes and sectors.

Study Methodology

The study approach included research and data collection, engagement with stakeholders and e-commerce experts, and a fresh look at previous PennDOT research, culminating in findings and recommendations. The study elements are illustrated in Figure 4 and described following the graphic.

Figure 4: Study Approach



Research

The research phase included the following:

- **Data-gathering** to understand economic, transportation, and land use trends and forecasts related to e-commerce, as well as current public policy.
- **Literature review** of 12 relevant studies, articles, and plans developed by the public and private sectors, within Pennsylvania and nationally.
- **Pennsylvania profile** examining characteristics of 17 e-commerce fulfillment centers of various types to compare their operational dynamics with those of traditional warehouse/distribution center facilities. The profile considered how different types of e-commerce facilities satisfy a range of important considerations for state and local governments.

Stakeholder Engagement

Interviews

The TAC conducted interviews with study stakeholders, including representatives of PennDOT, MPOs and RPOs, and key municipal partners (including municipal associations such as the Pennsylvania State Association of Townships and the Pennsylvania State Association of

Boroughs) to identify trends and issues related to e-commerce in Pennsylvania. A commercial real estate professional was also interviewed.

MPO/RPO Survey

Further, the TAC conducted a 10-question survey of the state's MPOs and RPOs to solicit regional perspectives on e-commerce activity, potential concerns, and opportunities. Of Pennsylvania's 24 MPOs and RPOs, 23 completed the survey. Results are summarized in the following chapter.

TAC surveyed Pennsylvania's MPOs and RPOs on e-commerce in their region; 23 provided feedback.

Expert Panel Session

The TAC hosted a 90-minute panel session convening subject-matter experts representing four aspects of e-commerce:

- The private-sector e-commerce industry
- Regional transportation and land use planning
- Local transportation and land use (both urban and rural)
- Industrial development to support e-commerce industry needs

The panel discussion was conducted virtually to facilitate cost-effective statewide participation. The audience included a wide variety of interests, including TAC members, PennDOT staff, MPO/RPO representatives, municipal officials, and others. Approximately 250 people registered for the event, with 186 logged in at the peak of participation.

Panelists offered their perspectives on issues and opportunities related to e-commerce, centered on the areas of transportation, land use, economic development, and/or public policy. The bulk of the session was dedicated to active discussion among panelists and with audience participants.

A summary of the expert panel session is provided in Appendix A.

More than 180 people attended TAC's virtual panel discussion with e-commerce subject-matter experts.

Package Delivery Fee Analysis

Reassessment of TROC Findings

Pennsylvania's 2021 Transportation Revenue Options Commission (TROC) considered a range of potential funding sources, including a package delivery fee. Because of its relevance to e-commerce, the TAC revisited the package delivery fee concept as presented in the TROC report in light of this study's other findings.

Other States' Experience with Package Delivery Fees

The TAC contacted State Departments of Revenue in Colorado and Minnesota, which have each implemented some form of package delivery fee. The TAC sought lessons learned on successes and challenges in creating and administering delivery fee programs. As this study was nearing completion, Maryland's Governor proposed a package delivery fee to fund transportation improvements.

MPO/RPO Survey Results Summary

Key Takeaways:

- To date, most Pennsylvania MPOs and RPOs have not produced analyses of e-commerce transportation and land use impacts.
- However, 18 of the 23 MPOs and RPOs responding indicated that e-commerce has impacted their region's transportation system.
- Increased traffic congestion and the additional impact on transportation system maintenance were reported through the survey.
- The survey response suggests that local government may not be prepared to deal with e-commerce growth (most respondents were unsure).
- Respondents believe that land use and zoning regulations have not kept pace with the rapid growth of e-commerce development.

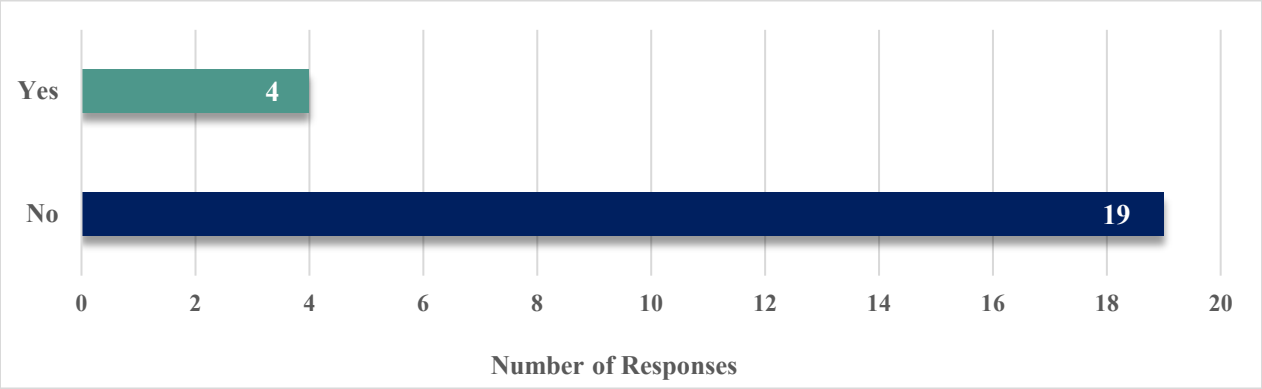
Survey Background

In June 2024, the TAC conducted a survey of the state's metropolitan and rural planning organizations (MPOs and RPOs) to establish a baseline of information related to e-commerce's impacts on transportation and land use at the regional and local levels. Of the 24 MPOs and RPOs statewide, 23 responded to the survey. Each region faces its own unique challenges related to e-commerce. The following pages summarize the responses received to each of the 15 survey questions.

Survey Results

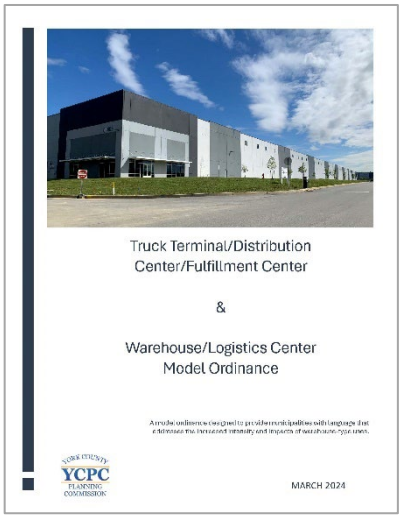
Has your planning agency conducted any studies or analyses on e-commerce, or do you intend to do so in the future?

Of the 23 regional planning organizations that responded, nearly 83 percent indicated they have not completed any studies or analyses related to e-commerce; however, they continue to monitor how e-commerce is evolving and may pursue studies in the future.



Of the four organizations that responded "yes," one has studied e-commerce while the remaining three consider e-commerce within their regional freight plans, including the following:

- The Delaware Valley Regional Planning Commission (DVRPC) completed several e-commerce studies and analyses through various lenses, ranging from goods movement and strategies for the region's retail districts to issues surrounding the digital divide. DVRPC's work includes a regional Impacts of E-Commerce report, the Philadelphia Truck Network and Complete Streets Integration Guidebook, and the Philly Freight Finder tool, among others. Several are described in the Literature Review chapter of this report.
- York Area MPO (YAMPO) produced its first regional freight plan in 2023 and subsequently established a Freight Advisory Committee. E-commerce is one of the topics the MPO plans to address with its Freight Advisory Committee. The MPO also developed a model ordinance for municipalities to consider additional language related to warehousing and similar uses.



- Five MPOs (Lackawanna-Luzerne, Lebanon, Lehigh Valley, NEPA, and Reading) collaborated on the development of the Eastern Pennsylvania Freight Alliance Regional Freight Infrastructure Plan. The eastern end of Pennsylvania has experienced

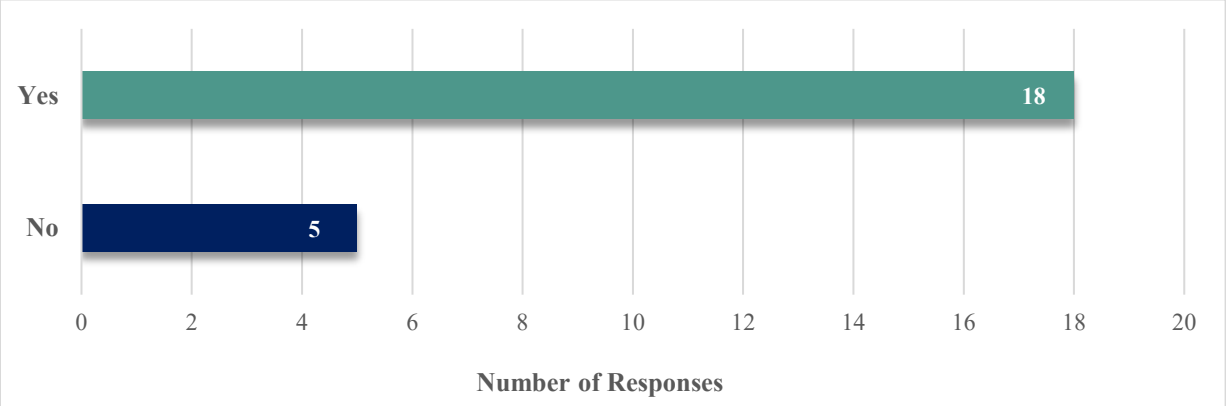
significant growth in freight and warehousing due to its strategic geographic position near several major East Coast markets.

- Lehigh Valley MPO has conducted studies regarding freight-based land uses and has used the results of those studies to provide guidance to its municipalities.

"We plan on continuing to keep an eye on the evolving e-commerce landscape and incorporating it into our work."

Has e-commerce impacted your transportation system?

Approximately 78 percent of the state's MPOs and RPOs indicated that e-commerce is impacting their regional transportation system.



The following trends were reported:

- **Observed Increases in Freight and Delivery Traffic** – Several MPOs/RPOs stated they have observed an increase in freight and delivery traffic on their region's Interstates, "Interstate look-a-likes," and lower-tier roadways that connect to these corridors. Related impacts cited included increased traffic congestion and the need for more frequent maintenance on roadway infrastructure.

"I'm sure it [e-commerce] is impacting our transportation network, but we have no idea how."

- **Observed Reductions in Passenger Vehicle Traffic** – Reductions in commuter and other passenger vehicle traffic have been observed due to more people working from home since the COVID-19 pandemic and fewer people driving to shop for goods at brick-and-mortar stores.
- **Pressure on Local Transportation Infrastructure and Downtown Areas** – Some planning regions said that they have observed increases in medium- and heavy-duty freight trucks driving on local roadways not designed to handle the size or weight of

these vehicles. Large, heavy-duty trucks traveling through small towns have also contributed to congestion.

- **Growing "Curbside Competition"** – The state's more urban areas highlighted growing competition for curbside space due to increases in delivery vehicle traffic, larger trucks making business deliveries, and third-party food delivery companies like DoorDash and Uber Eats.

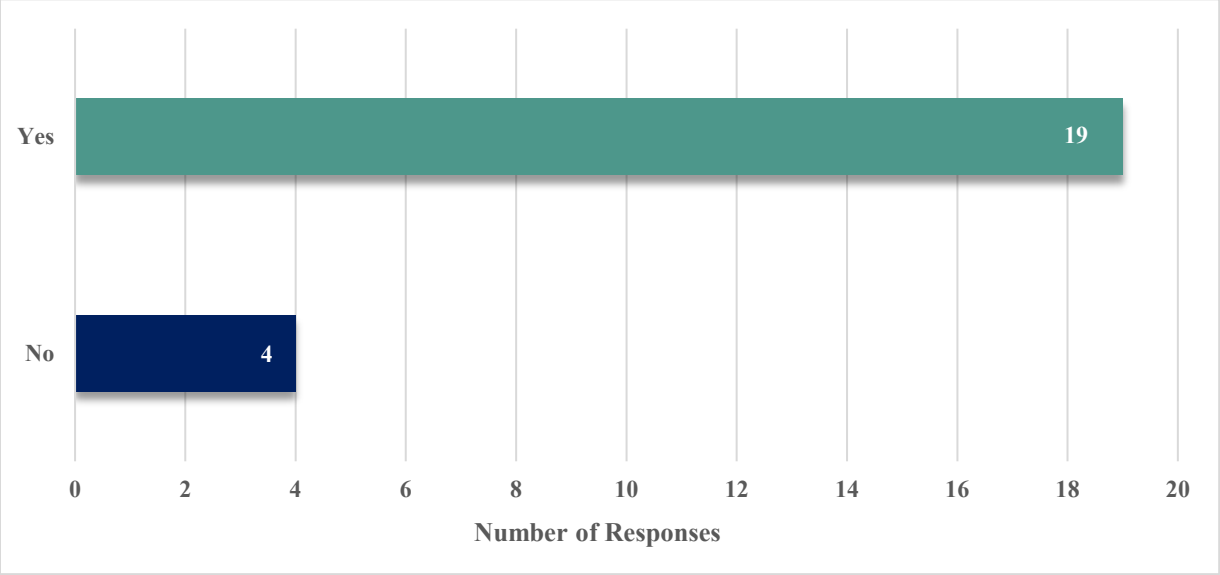
Philadelphia photo courtesy of Sam Arnold.

- **Increase in Air Cargo and Intermodal Traffic** – Increases in air freight traffic related to e-commerce (UPS, FedEx, Amazon PrimeAir) were mentioned by several regions whose transportation networks include commercial service airports (e.g., Philadelphia, Lehigh

Valley). This growing activity also increases demand for landside traffic/connections off airport property as cargo proceeds to the next destination.

Has e-commerce impacted land use/development in your region?

When asked about land use, 19 regional planning organizations indicated that they have observed some level of impact on land use in their region because of e-commerce.



Open-ended insights included the following:

- **"Significant changes to the landscape"** – Nearly all regions noted an increase in warehousing and fulfillment center construction (including some that are miles away from limited-access roadways and other major corridors). Some of these facilities are existing buildings that have been repurposed/redeveloped or the conversion of land previously undeveloped or used for agriculture, natural uses, etc., into industrial centers.

"The development of distribution centers on previously agricultural or undeveloped land is prompting changes in zoning and land use policies to accommodate in areas where these policies exist."

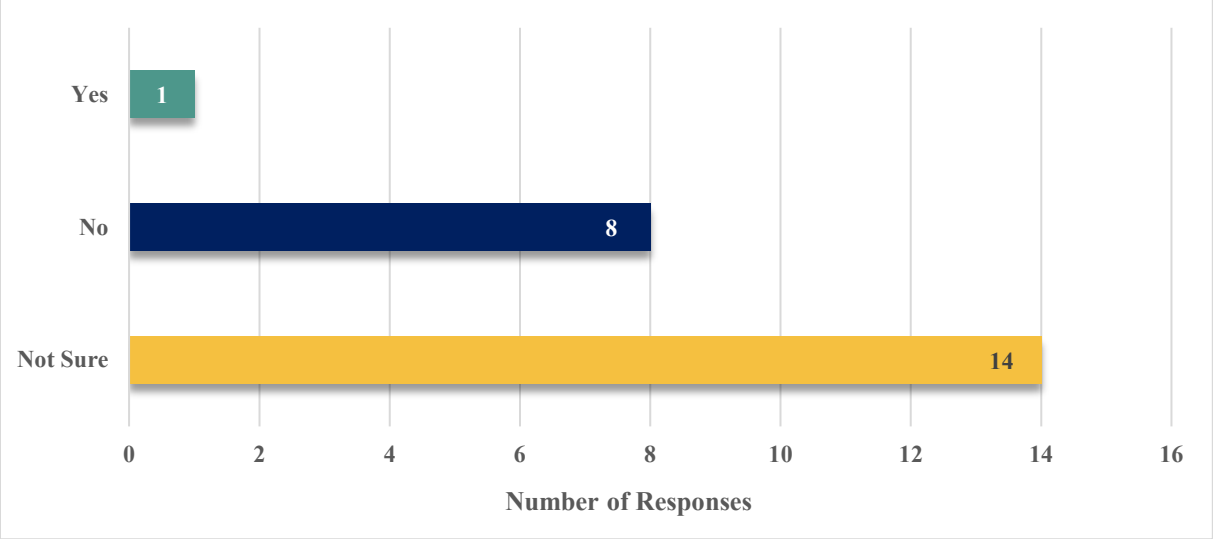
- **Shifts in Economic Activity** –MPO/RPO regions are seeing retail spaces like shopping malls and other standalone brick-and-mortar retail establishments being repurposed into e-commerce-based uses. Local businesses and downtown cores are struggling to compete with the convenience of online shopping and delivery, which has led to the closure of some of these businesses.

"Traditional small businesses are struggling as residents increasingly shop online, leading to vacant storefronts, less foot traffic, and quieter downtowns."

- **Impacts on Residential Land Uses** – Increased demand for housing and new residential development is generating greater demand for e-commerce deliveries. This, in addition to warehousing demand, is putting pressure on local infrastructure and services (e.g., roadways, water/sewer, and other utilities) to keep pace and adapt (e.g., road upgrades to accommodate increased delivery traffic; new developments needing water/sewer service, etc.).
- **Greater Need for Truck Parking and Staging** – Several MPOs stated that increases in freight movement and warehousing demand have led them to explore the potential for more/expanded truck parking and staging facilities to avoid roadside issues.

Are local communities prepared to address the impacts of e-commerce?

MPOs and RPOs were asked if local communities are prepared to address the growing impacts of e-commerce using three multiple choice options: "yes," "no," or "not sure." Of the three options, the majority (14) stated they were "not sure" if local governments were prepared. Eight organizations indicated that local governments are not prepared, while only one felt that they are equipped to address e-commerce impacts.



Open-ended comments centered around the following themes:

- **Varied Impact in Urban vs. Rural Areas** – Some of the state's more rural regions indicated that their municipalities are adjusting to e-commerce but see the impact as not as great as in more urban areas. Several rural areas are still comparably more reliant on in-person commerce.
- **E-Commerce is Outpacing Land Use Regulations** – Some MPOs and RPOs noted that their municipalities seem to have an increased awareness of the issues related to e-commerce growth and development, but not so much in terms of the overall impact e-commerce can have on their community. Land use and zoning regulations have not kept

pace with the rapid growth of e-commerce development (some zoning is outdated, while some municipalities do not have any regulations at all). Additionally, they believe that communities may not be considering previous comprehensive planning and zoning efforts in their decision-making around e-commerce development. Similarly, the general public living in these communities may not be making the connection between their use of e-commerce and the need for more e-commerce/trucking facilities.

- **Lack of Resources and Capacity** – Some MPOs/RPOs stated that local governments recognize the strain increased delivery traffic has on their roadways, but struggle to find the funding to maintain or upgrade their local road infrastructure to keep up with the pace of e-commerce. Similarly, many local governments do not have the institutional capacity to become experts on topics like e-commerce before development pressure is upon them.
- **Private-Public Barriers** – E-commerce growth is driven by private market actions (e.g., developers and operators) and it is challenging for communities to connect with e-commerce entities. Several MPOs and RPOs also expressed the lack of effective engagement in general with private freight interests, including those related to e-commerce, as a barrier to community/transportation planning.

"Communities are mostly in a reactive mode. Most municipalities have also not sought to understand the impacts of additional truck (and delivery van/truck) activity on their roadways."

"Local communities are becoming aware of the growing need that has come with an increase of freight traffic due to e-commerce, but are still coordinating and developing pertinent strategies … to tackle the issues."

What do you think are the primary issues and opportunities related to e-commerce in your region?

Issues	Opportunities
▶ Lack of digital infrastructure/internet connectivity ▶ Digital literacy of local/small businesses ▶ Truck traffic growth and associated impacts on system condition/operations ▶ Truck routing ▶ Truck parking capacity ▶ Public opinion and perception of e-commerce ▶ Environmental impact/degradation ▶ Economic stagnation and/or displacement of traditional small/downtown businesses ▶ Zoning and land use keeping pace ▶ Limited funding for infrastructure improvements ▶ Land use conflicts ▶ Impacts of technological advancements ▶ Rural last-mile deliveries	▶ Research/analysis and technical assistance opportunities ▶ Increase in jobs and economic opportunities ▶ Delivery trip reduction strategies

How should the public sector (state, regional, local levels) be preparing for the assumed growth of e-commerce?

When asked how the public sector should prepare for the growth of e-commerce, the state's MPOs and RPOs offered a wide range of ideas related to infrastructure, economic and business development, land use, and collaboration, including the following:

- Address roadway/transportation infrastructure deficiencies in areas currently zoned for new warehousing/logistics uses as well as those where increased truck volumes are expected.
- Maintain and upgrade rural roads to handle increased delivery traffic volumes.
- Prioritize funding for projects on regionally and locally identified freight networks.
- Ensure that land development and zoning regulations are considering e-commerce uses.
- Support small businesses through grants, training, and resources to help them adapt to the digital economy.
- Identify and implement economic development strategies to address blight and job loss from the closure of brick-and-mortar stores. Analyze the impact of brick-and-mortar losses on various tax revenue streams.
- Ensure MPOs and RPOs address e-commerce as part of regional long-range transportation plans and encourage the development of regional freight plans.
- Pursue ongoing relationships with e-commerce providers and other private-sector logistics stakeholders.

Photo credit: Mike Dot – stock.adobe.com

- Partner with the Pennsylvania Planning Association (PPA) and Pennsylvania State Association of Township Supervisor (PSATS) and other local government associations on sharing educational materials on the impacts of development and delivery services related to e-commerce.
- Update the MPC to strengthen the role and authority that counties and regional entities have in the land development process to better ensure a linkage between land use and transportation.
- Encourage all MPO and RPO regions to develop their own regional freight plans.
- Quantify the need for truck parking and evaluate methods and strategies to meet that need.
- Explore and pursue data that illustrates the impact of e-commerce at all levels.
- Invest in upgrading operations and capacity on regional corridors that are not yet capable of handling e-commerce-related traffic growth.
- Encourage local governments to regularly review and update their subdivision/land development and zoning ordinances to best address the impacts of e-commerce growth.
- Develop a comprehensive strategy for the intermodal movement of packages (e.g., rail, air) to help reduce pressure on the highway and bridge network.

To what extent will the assumed future growth of e-commerce impact travel, transportation system operations, and infrastructure in your region?

When asked about the extent of impact that future e-commerce growth will have on regional transportation, respondents offered the following insights:

- **Potential for Impact Shifts to Lower-Tier Networks** – As some regions see more e-commerce/ fulfillment/warehousing development farther away from their limited-access highways and principal arterials, overall impacts will be on minor arterials and major collectors. This could have congestion, maintenance, and traffic safety implications.
- **Geographic Position Influences** – Some MPOs noted that their centralized geographic positions make them gateways for freight traffic accessing a diverse range of regional and national markets. Because of this, they anticipate travel, operations, and infrastructure impacts.
- **Pressure on Rural and Local Transportation Systems** – Increased strain on rural and local transportation systems will lead to higher maintenance costs and the need to upgrade road and bridge infrastructure to handle heavier, more frequent vehicle loads.
- **Infrastructure Expansion and Coordinated Planning** – The increased demand for distribution and warehousing developments will drive the need for infrastructure expansion, including improvements to roadway networks, utilities, and broadband access.

Expanding infrastructure capacity will require coordinated planning and investment at the local, regional, and state levels to efficiently accommodate the growth of e-commerce.

- **Business/Economic Development Impacts** – Decreased local tax revenue from job losses and closure of brick-and-mortar businesses (notwithstanding revenue gains from e-commerce) will impact the ability to fund infrastructure improvements, while the increased strain on regional transportation networks will require more maintenance and repairs.
- **Minor Impacts** – Several MPO/RPO regions specified that they will face minor impacts due to population declines. Others in more rural regions stated that impacts will be minor as e-commerce growth is slower/more limited in rural areas.

Decreased local tax revenue from job losses (notwithstanding revenue gains from e-commerce) and closure of brick-and-mortar businesses will impact the ability to fund infrastructure improvements, while the increased strain on regional transportation networks will require more maintenance and repairs.

What recommendations would you offer regarding funding or any other facet of the public-sector response and preparation for impacts of e-commerce-related transportation?

In addition to providing input on the extent of e-commerce's impacts, the regional planning organizations were asked for recommendations regarding public funding or other areas that would help address the transportation impacts of e-commerce. Several common recommendations emerged, including:

- **Planning for Less Commuting and More Shipping**: With increases in remote work and increases in shipping traffic, Pennsylvania and its regions should plan for lower volumes of passenger traffic and higher shipping volumes (e.g., trucking) on the transportation system.
- **Identifying Future, Supplemental Transportation Revenue Sources**: This will be essential as the amount of local and statewide funding available for transportation improvements is expected to remain strained with less revenue received via the gas tax.
- **Freight Network Funding:** Prioritize funding on locally and regionally identified freight networks as critical links to the National Highway Freight Network.
- **New or Updated Planning Tools:** Develop and improve planning tools and processes to address large uses with regional impacts and sensible e-commerce accommodation.
- **Fee and Tax Ideas:** Several respondents identified ideas for potential fees or taxes that could help fund e-commerce-related infrastructure upgrades and improvements, including

a corridor usage fee, package delivery fees, or other local/regional level taxes on e-commerce deliveries. One respondent recommended something similar to the Act 89 $5 local use fee to address infrastructure wear-and-tear.

Several respondents identified ideas for potential fees or taxes that could help fund e-commerce-related infrastructure upgrades and improvements.

- **Balancing Urban and Rural Infrastructure Needs:** Transportation funding should be strategically allocated to prioritize the maintenance and upgrading of rural roads that are heavily impacted by an increase in delivery traffic.
- **Land Use Regulation/Ordinance Upgrades**: Several respondents suggested working with local officials to amend zoning/land use ordinances to address needs such as truck parking to ensure that drivers have adequate locations to park and rest. Others recommended updating the MPC to address larger logistics facilities and their associated impacts.
- **Program and Policy Recommendations**: One respondent recommended focusing on programs and policies aimed at offsetting the negative impacts of e-commerce activity such as: funding improvements in the public realm, grant funding for EV charging infrastructure, providing digital literacy training programs for small businesses, rethinking access to/how curbs function in dense urban areas, supporting efforts to reactivate traditional retail districts, and encouraging collaboration among developers, public agencies, and Transportation Management Associations (TMAs) to link employees with e-commerce jobs.

Has or will e-commerce have other non-transportation impacts that should be considered as part of the study process (e.g., equity, environmental impacts, land use policy/regulations, economic development)?

In addition to the transportation impacts resulting from e-commerce growth, the MPOs and RPOs indicated that the following non-transportation impacts be considered:

- **Economic Development and Business Impacts**: This includes impacts on retail sales establishments and other commercial-use properties. Respondents also recommended considering the impacts of e-commerce on the workforce and business development (i.e., small businesses may need training to increase digital literacy/have an online presence).
- **Workforce Access and Public Transportation**: It was suggested that transit should have greater priority in the siting of logistics facilities, which tend to be located in more sprawling suburban areas while some of the potential workforce live in the dense urban/downtown areas. A lack of public transportation to these jobs could pose job access barriers for environmental justice (EJ) neighborhoods.

- **Balancing Financial and Community Impacts**: Several regional planning organizations recommended a balance between the financial benefits (increased tax revenue, etc.) vs. community impacts. This could include an evaluation of impacts to regional housing markets.
- **Evaluate Pennsylvania's Demographic Picture**: With a growing aging population, the demographic composition of Pennsylvania needs to be evaluated to ensure e-commerce uses can be supported and sustained. This includes ensuring workforce availability to support the growing number of e-commerce facilities while also dealing with the high rate of turnover assumed to be typical for these positions.
- **Environmental Impacts**: Environmental impacts should be considered, including increases in emissions/air quality impacts, the e-commerce waste stream, stormwater management, and loss of agricultural land.
- **Urban/Rural Differences:** Consider urban and rural differences when evaluating the potential impacts of e-commerce.

What localities or areas within your region are experiencing the greatest impact/concentration of e-commerce activity (site-specific locations or industrial development projects), if applicable?

Asked about specific areas of concentrated ecommerce activity, the regional planning organizations offered a diverse range of responses. Several organizations simply noted that increased activity is being observed across the entirety of their regions, while others highlighted specific roadway corridors or localities that were perceived to be areas experiencing the greatest impact. The question was posed with the assumption that some patterns might emerge.

Some examples of locations provided in both urban and rural areas of the state include:

- DVRPC (serving Philadelphia, Bucks, Delaware, Montgomery and Chester counties in Pennsylvania) noted they have been experiencing e-commerce impacts on both the Pennsylvania and New Jersey sides of their region. Within Pennsylvania, areas of activity include Falls Township, Bucks County; Philadelphia's Bellwether District; and properties surrounding the Philadelphia International Airport.
- The Harrisburg Area Transportation Study (HATS) observes that the impacts of e-commerce are reflected by the warehousing and freight activity throughout the region. This includes along I-81 in Carlisle and PA 233 in Newville (Cumberland County); Watts Township in Perry County; the US 322 corridor in Swatara Township, Dauphin County; and Londonderry Township, Dauphin County.
- The Southwestern Pennsylvania Commission (SPC), serving Pittsburgh and surrounding counties, highlighted the I-376, I-76, and I-79 corridors as well as warehouse/distribution activity in New Stanton, Imperial, and North Versailles.

- The Lehigh Valley Planning Commission stated that while they are seeing impacts in nearly all their communities, notable examples include the area around Lehigh Valley International Airport, the Borough of Bath (Northampton County), and Alburtis Borough (Lehigh County) along with the cities of Allentown, Bethlehem, and Easton.
- The Northwest RPO envisions that the greatest area of impact would be around their shopping mall areas, specifically in Cranberry and Clarion.
- SEDA-COG MPO noted that the level of activity is dispersed around the region due to the presence of major corridors including I-80, I-180, US 15, and US 11. In neighboring Lycoming County (WATS MPO), activity has been observed in Williamsport, Montoursville, and Muncy.
- North Central RPO has observed the most impact in the region's core communities of DuBois, Bradford, and St. Marys, where large shopping centers and shopping malls are facing closures. Smaller communities in the region are facing declines in foot traffic in local downtowns, which has impacted activity at downtown/small businesses.

Literature Review

Key Takeaways:

- Retail businesses, including those employing e-commerce business models, are shifting to "omnichannel" approaches, leveraging a mix of online and in-person services for the purchase, fulfillment, and last-mile distribution of goods to consumers.
- The pandemic accelerated the expansion of e-commerce, making the need for assessment for the public sector particularly timely and important.
- E-commerce is a diverse sector with a wide range of services in addition package delivery.
- A Center for Transportation Research at the University of Texas study concludes that even if in-person consumer trips decrease because of e-commerce that there will still be a net increase in traffic with heavy commercial vehicle travel.

To establish a greater understanding of e-commerce in relation to public-sector transportation and land use, the TAC conducted a broad literature review. This section summarizes that research. The data and sources referenced were selected based on their relevance to e-commerce's impacts to transportation and land use as well as their recency of publication (most within the past five years) in an effort to understand the current state of the industry and associated impacts through several viewpoints.

Growth in E-Commerce

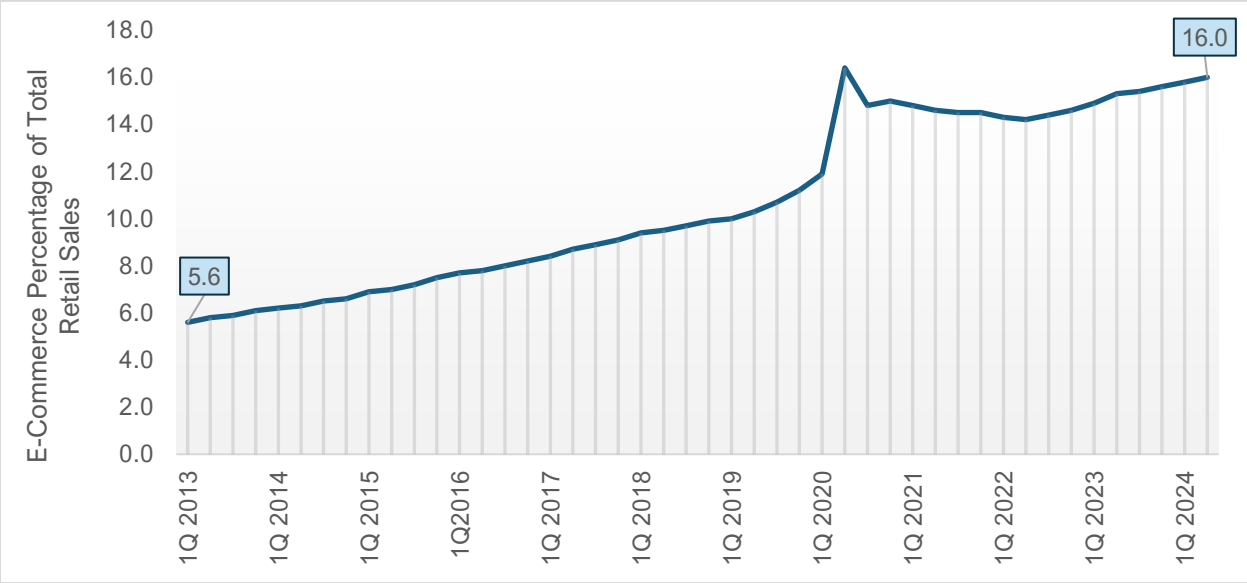
Quarterly Retail E-Commerce Reports

U.S. Census Bureau, 2013–2024

As of Fall 2024, the Quarterly Retail E-Commerce Report from the U.S. Census Bureau found that e-commerce's share of total retail sales nationwide continues to increase. Since the first quarter of 2013, e-commerce's share of national retail sales has nearly tripled, totaling $291.6 billion (16 percent of all retail sales) in the second quarter of 2024 (Figure 5).

E-commerce's share of national retail sales has nearly tripled over the past decade; the trend is expected to continue.

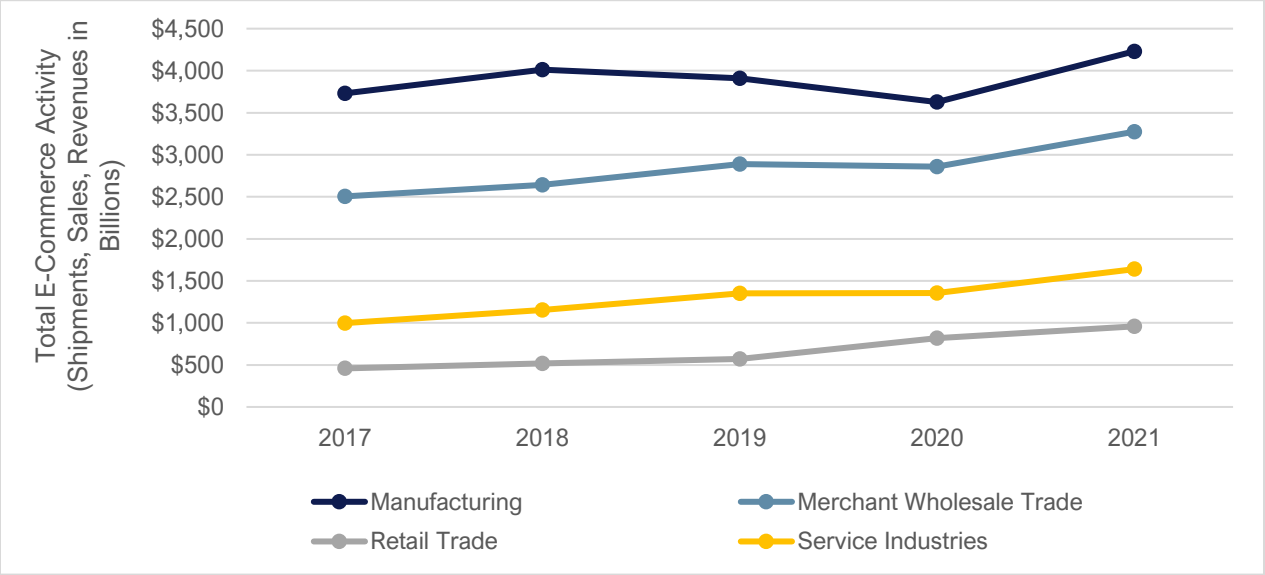
Figure 5: E-Commerce Share of Total Retail Sales, United States (1Q 2013–2Q 2024)



Source: U.S. Census Bureau, "Quarterly Retail E-Commerce Report," Seasonally Adjusted Time Series, August 2024

Beyond retail sales, U.S. Census Bureau data on national e-commerce activity (including sales, shipments, and revenues) in other industry sectors also shows growth. The Bureau's E-Stats Annual Reports for 2018–21 report increases in manufacturing, merchant wholesale trade, retail trade, and service industry sectors due to e-commerce. Over the five-year period, retail trade experienced the most notable growth, with a 106 percent increase between 2017 and 2021, followed by service industries (61 percent), merchant wholesale trade (31 percent), and manufacturing (13 percent), respectively. (Note that e-commerce serves to enhance economic activity broadly and should be viewed in that context.)

Figure 6: Total E-Commerce Activity by Sector (2017–2021)



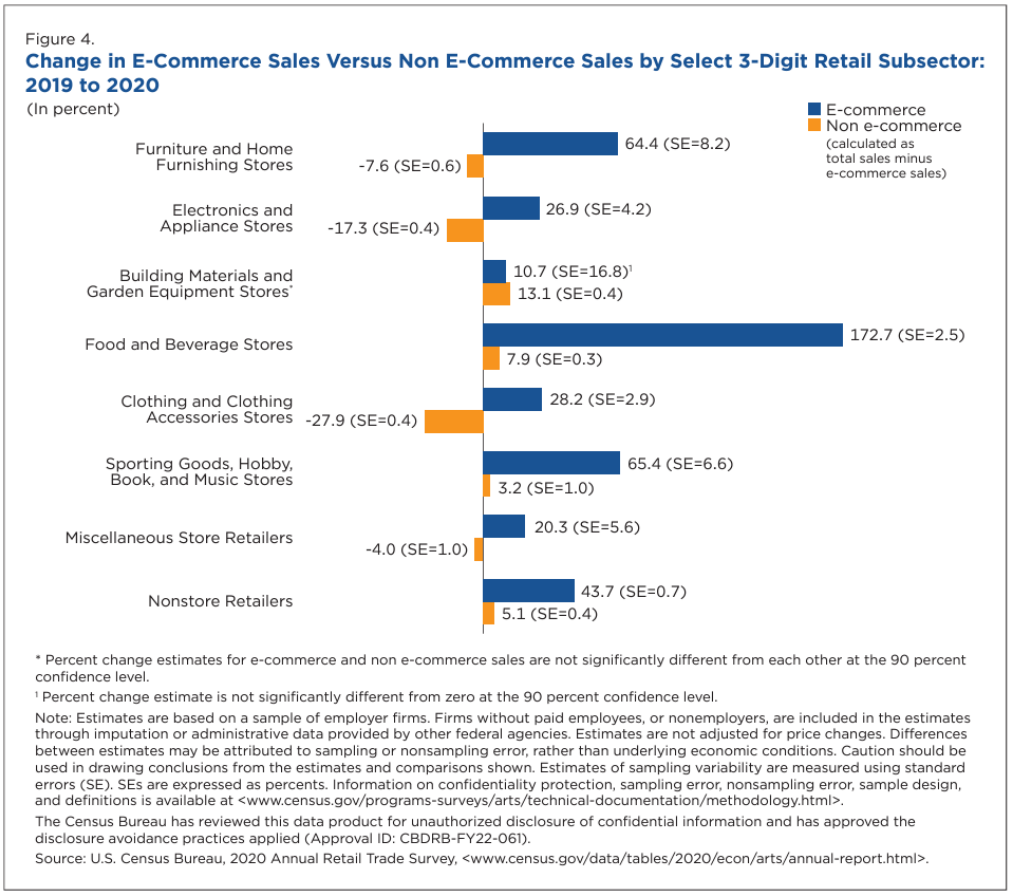
Source: U.S. Census Bureau, E-Stats Annual Reports, 2017-2021

The Coronavirus Pandemic's Economic Impact

U.S. Census Bureau, July 2022

In addition to its regular reporting of economic data, the U.S. Census Bureau studied the impacts of the COVID-19 pandemic on numerous economic indicators, such as manufacturing business closures, wholesale and retail trade sales, e-commerce sales, and state/local tax revenues, among others. With the advent of social distancing and stay-at-home orders, the pandemic accelerated a national shift of retail operations from in-store transactions to e-commerce.

When considering retail e-commerce sales by primary business activity, food and beverage stores recorded the most significant increase in e-commerce sales at the height of the pandemic (173 percent increase from 2019 to 2020), followed by sporting goods/hobby/book/music stores (65 percent) and furniture/home furnishing stores (64 percent), respectively. E-commerce divisions of brick-and-mortar retailers (categorized under "non-store retailers") also recorded a nearly 44 percent growth in e-commerce activity. In contrast, merchant wholesalers experienced a 6.6 decline in total sales between 2019 and 2020.



Source: U.S. Census Bureau, "The Coronavirus Pandemic's Economic Impact," July 2022, page 5.

E-Commerce and the Future of Land Use

Richard Stein, AICP, in *Zoning Practice*, American Planning Association, January 2020

- Although new e-commerce fulfillment facilities will continue to come online to meet increased demand, physical storefronts and brick-and-mortar stores are anticipated to continue playing a role in the new retail landscape. Retail is likely to shift to an "omnichannel" approach, with consumers leveraging a mix of in-person and online shopping methods (e.g., online, mobile apps, buy online/pick up in store, in-store shopping).

- Businesses have found that online sales or in-person sales alone are not enough to be sustainable, leading them to invest in hybrid models. As such, businesses that previously operated entirely online are beginning to invest in storefronts and vice versa.

Has e-commerce peaked?

The Economist, August 2023

- While the share of e-commerce sales recorded a notable "spike" in early 2020 (the onset of the COVID-19 pandemic), overall trends in national online retail spending remain stagnant. The article reports that this trend is "roughly what would have been if pre-pandemic trends were uninterrupted."

- Online retail spending trends by sector vary depending on the product offered. Certain items, such as clothing and furniture, have consumers returning to physical stores to shop in person while others, like food/grocery items, are seeing a slow and steady increase in online sales. In 2019, the share of grocery shopping completed online in the United States was at 4 percent. This increased to 7 percent in 2020 and subsequently to 9 percent in 2022. The grocery business, however, is struggling with the cost of employing additional labor to fulfill and deliver online grocery orders due to thin operating margins. The article cites an analysis by McKinsey, a consultant firm, which found that 47 percent of Americans would do more grocery shopping online if the delivery fees imposed by these retailers were lower. Most growth in online grocery shopping will be concentrated on curbside pick-up at the stores, rather than delivering to customer doorsteps.
- E-commerce and online retailers continue to adapt by using new advertising mechanisms through social media platforms. The article specifically cites TikTok and Meta ("Instagram Reels")'s influence on online shopping trends—referred to as "shoppable entertainment"—and the use of ads in their content that allow users to purchase products without leaving the app.
- Many retail companies/brands are seeking to move away from "the middleman" and focus efforts on direct-to-consumer sales, which have quadrupled over the past eight years.
- Online shopping has led to greater shifts in consumer behavior by increasing overall confidence in buying online and the Internet's influence on where and how they spend their money—researching purchases online before heading to a brick-and-mortar store to complete a purchase (e.g., vehicle purchases) or using the Internet to compare competing prices for a particular product or service.
- Fast, reliable broadband Internet access has been a key driver in the rise of e-commerce and Internet business overall, empowering more entrepreneurs to reach a worldwide audience in a cost-efficient manner and providing another sales channel for consumers to make purchases.

Land Use Impacts and Considerations

E-Commerce and the Future of Land Use

Richard Stein, AICP, in *Zoning Practice*, American Planning Association, January 2020

- E-commerce companies tend to locate their fulfillment and distribution facilities close to their consumers to decrease the total amount of time it takes to complete a delivery, all while using transportation infrastructure operated by the public sector. This is more prevalent now, with retailers like Amazon and Walmart adjusting their business models, promising deliveries within one day, the same day, or even within a few hours of placing an order.

- Larger fulfillment centers tend to be located in "semi-industrial, transitional areas between urban and rural places" that are well connected to the highway network and where the cost of land is comparably lower.
- Existing brick-and-mortar retail locations, such as large shopping centers/big box stores, are starting to take on roles as "de facto" fulfillment centers. Online orders placed with large national retail chains that have both an online and brick-and-mortar presence are filled not only from dedicated fulfillment centers, but from the retail stores themselves.
- For one-day shipping alone, Amazon would need to reduce the expanse of its Prime-eligible inventory and would need to construct 340-360 delivery stations or fulfillment centers nationwide to compete with Walmart (which has locations within a 15-minute drive of 90 percent of U.S. households). To compete with even shorter delivery times (same-day or several hours, for example), major e-commerce retailers would need to concentrate on the redevelopment of land previously occupied by high-intensity uses (e.g., malls) or partner with existing retailers.
- Stein poses some additional land use and zoning considerations for planners and local governments related to e-commerce impacts:
    - Typical neighborhood shopping centers are located on the outer fringes of communities and tend to be surrounded by single-family, car-dependent housing.
    - "Main Street" and local shopping tend to have more focus on the shopper experience as consumers will make many in-person shopping decisions based on the surroundings and amenities for those purchases that are not online.

The Explosion of E-Commerce Deliveries in Cities: Predictive Analytics as a Planning Tool (TRB Recap Series #3)

Peter Plumeau, EBP, 2019

- On average, every $1 billion in e-commerce sales growth requires an additional 1.25 million square feet of warehouse space. E-commerce businesses are exploring a variety of delivery methods and business models to address this demand for space. These strategies include the use of traditional retail business models in combination with package delivery/pick-up, package delivery lockers, micro-fulfillment centers (which the author defines as "the use of inner-city vacant spaces as satellite distribution points"), and vertical (multi-story) warehousing.

Evaluate Logistics Sprawl's Impacts on E-commerce Travel Patterns

Katherine Asmussen, et.al, University of Texas at Austin Center for Transportation Research, Technical Report 0-7165-1, February 2024

- The authors have observed conflicting patterns in where e-commerce/logistics companies locate their facilities. On one hand, they note e-commerce facilities are locating on the urban fringe/suburban areas and close to transportation connections (e.g., highways, railroads, intermodal terminals), resulting in lower land costs and overall operational costs to the logistics companies. They also observe the opposite, with e-commerce

facilities locating closer to dense population, employment, and transportation hubs to meet increasing consumer demands for faster deliveries.

- Review of other academic literature found that these facilities are gravitating closer to residential, employment, and transportation hubs than in the past. In 2016, the average warehouse was about 24 miles from the nearest transportation hub for freight/logistics (e.g., airport or port) and 27 miles from dense population centers. As e-commerce demand has grown, warehouses are now locating less than 20 miles away from these hubs, while distribution/fulfillment facilities are now appearing within 10 miles of a hub.
- Different e-commerce companies have different clientele (e.g., UPS/FedEx covers both urban/rural areas; Amazon has a more urban clientele but also uses FedEx to help expand its delivery reach).

Transportation Impacts and Considerations

E-Commerce and the Future of Land Use

Richard Stein, AICP, in *Zoning Practice*, American Planning Association, January 2020

- New and emerging technological advancements such as artificial intelligence, robotics, and autonomous delivery mechanisms are being implemented throughout the e-commerce supply chain, allowing more orders to be fulfilled quickly. Related data processing and analytics can ultimately help retailers understand the types and amounts of inventory they need to make fast deliveries.
- If brick-and-mortar retail locations begin to serve in more of a fulfillment capacity, traffic volumes entering/exiting these facilities may ultimately balance out–with delivery vehicles replacing consumer vehicles.
- Parking requirements for shopping centers should be reevaluated if fewer consumers are fulfilling the "last mile" in their own vehicles and instead are having goods delivered to their homes.

Evaluate Logistics Sprawl's Impacts on E-commerce Travel Patterns

Katherine Asmussen, et.al, University of Texas at Austin Center for Transportation Research, Technical Report 0-7165-1, February 2024

- Even if in-person consumer trips decrease because of e-commerce, the authors find that a net increase will still occur with heavy commercial vehicle traffic. This is primarily driven by the need for delivery companies to deploy additional trucks and vans to meet the expectations of their customers for faster deliveries. As a result, travel times will also increase, which may cause delivery delays. To make up for these delays, logistics/e-commerce companies may end up deploying even more additional vehicles.

E-Commerce in the Pennsylvania Context

Living with Logistics Report and Model Ordinance

PennFuture, July 2023

- PennFuture[2] puts out a "call to action" for municipalities to be proactive by adopting ordinances that reflect more intensive logistics uses, allowing them to plan for and mitigate the impacts of modern-day logistics development. The report categorizes "modern-day" logistics development as more intensive than that of years past, citing the rise of e-commerce as a primary catalyst as logistics facilities shift away from a focus on wholesale and bulk storage for in-store retail to a focus on fulfillment/shipping with longer hours of operation and more truck traffic.
- PennFuture engaged with several communities in Northeastern Pennsylvania that are responding to rapid development pressure from these logistics facilities. Several municipalities in the region have tailored and adopted the group's recommended model ordinance since it was released.
- PennFuture makes recommendations to the state's municipal governments on how to best tailor zoning ordinances to both accommodate modern-day logistics development and mitigate its impacts. This includes recommendations on avoiding exclusionary zoning practices, crafting suitable definitions, deciding where to permit logistics uses, and approaches to site-specific zoning reviews. Although land use and zoning are managed at the local level, several of the report's recommendations could be applicable statewide through updates to the Pennsylvania Municipalities Planning Code (MPC) or broadly supported at the state level, including:
    - Define and use zoning overlay districts to pinpoint the best locations for logistics uses and mitigate environmental and community impacts.
    - Define and distinguish between "large logistics facilities" and "small logistics facilities" as well as "between facilities that will generate significant traffic impacts and those that won't."
    - Ensure that the direct and cumulative impacts of logistics development in the local community are considered when deciding where logistics development should occur.
    - Encourage logistics development in areas that are compatible with existing land use patterns/nearby uses and in areas where there is suitable access to highways, multimodal freight opportunities (e.g., rail and air), and public transportation for workers.

[2] https://www.pennfuture.org/

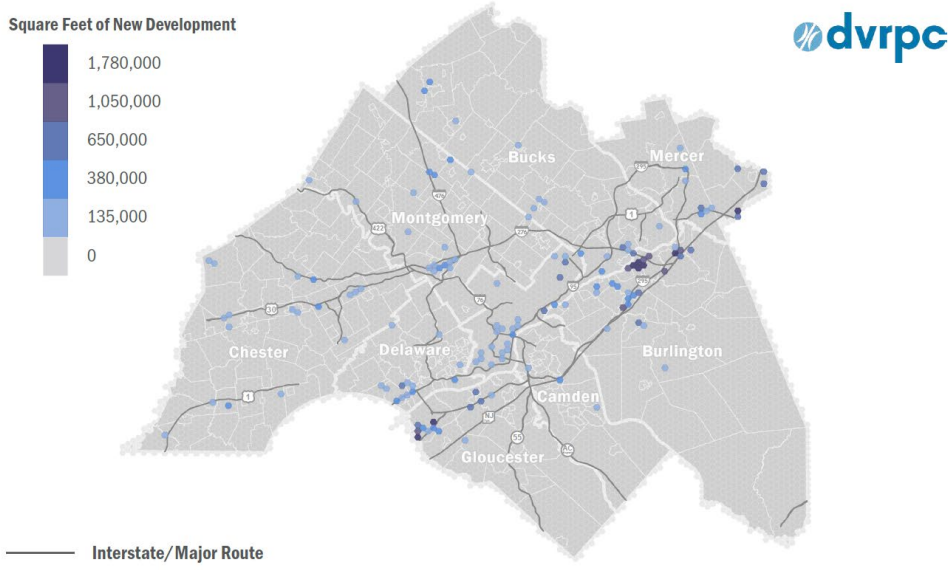
- Prioritize placement of logistics uses on underutilized land/brownfield sites.

Impacts of E-Commerce

Delaware Valley Regional Planning Commission, February 2024

- Omnichannel approaches are becoming more common in the purchase, fulfillment, and delivery of goods. Retailers are leveraging a hybrid of in-person and online models and strategies, including curbside pick-up; buy online, pick up in store; buy in store for delivery; etc. E-commerce companies are also evolving to not only meet demand for faster deliveries but to accommodate an increase in returns by mail.
- The main forces driving e-commerce warehouse siting are consumer needs, proximity to ample workforce, the existing supply of space, and proximity to infrastructure. The DVRPC region has been attracting distribution and warehousing development due to its geographic location along major highway corridors such as I-95 and I-76, and proximity to major markets in the northeastern United States and Canada. In 2023, the region recorded a total of 474 million square feet in logistics/flex space development and has observed increased development pressure closer to dense urban centers.

Figure 2: Industrial Warehouse Development Since 2012



Source: CoStar (2022)

- DVRPC staff identified four broad categories and eight aspects of potential impact that localities should consider related to the development of e-commerce facilities: environmental (air quality, stormwater), fiscal (local budgets/taxes, services/utilities), transportation (truck parking/fueling, road congestion/wear), and community-based (job creation, community character).
- To address these potential impacts on a local level, DVRPC identifies a series of policy strategies and interventions around municipal codes, site planning, workforce access, and

transportation planning. Several of these strategies could apply or be supported at the statewide level, including:

- Provide electric vehicle infrastructure.
- Provide employee access to e-commerce facilities using multiple modes of transportation, including carpooling and vanpooling.
- Encourage truck routing on routes that are appropriate/able to handle higher truck volumes.

Philadelphia Delivery Handbook

Delaware Valley Regional Planning Commission, April 2017

- The primary goal of the Philadelphia Delivery Handbook is to "lay the groundwork for fostering a delivery-friendly city, one where deliveries are executed in ways that are equally as conducive and sensitive to business interests as they are to individual communities."
- Three primary issues facing urban deliveries in Philadelphia include a lack of safe/designated spaces to load/unload deliveries; delivery trucks blocking passenger vehicles, cyclists, and pedestrians; and undelivered/stolen packages.
- The ease and convenience of e-commerce options/purchases and an increased demand for faster deliveries are just two factors cited as contributors to the anticipated future growth of deliveries in Philadelphia. In addition to these impacts, other factors include:
  - More high-rise buildings (e.g., structures over 75 feet tall) and infill development.
  - Proliferation of jobs and work sites in the office, service, and retail sectors.
  - Greater occurrence of smaller businesses and more multi-business office buildings.
  - Appearance of nationally recognized stores with less storage space and high inventory turnover.
  - Growth of deliveries to buildings/residences that are not equipped with the appropriate loading/unloading facilities (external and internal).
  - Population resurgence and gentrification pressures.
  - Increased per-capita purchasing power.
  - Changing lifestyles and Millennial generation influences that impact discretionary spending and non-essential purchases.
  - Consumer preference for fresh and ethnically diverse food items.
- DVRPC conducted a literature review that identified eight potential urban delivery best practices that could potentially be implemented in Philadelphia:

- Delivery by Design: Implementing delivery considerations into the development process can create opportunities for buildings to design alleys, off-street loading bays, and even internal or underground delivery facilities.
- Curbside Orchestration: Strategies that provide better accommodation for curbside, on-street deliveries.
- Off-Hour Delivery Programs: Freight delivery activity is shifted to a period of the day when roads are less congested and loading facilities are more easily accessible.
- Delivery Consolidation: Consolidation of deliveries from multiple shippers into one vehicle and trip and/or from a single shipper with multiple deliveries along one corridor.
- Alternate Delivery Sites: Centrally located lockers or neighborhood pick-up points.
- Delivery Fleet Mix: Diversifying delivery/cargo vehicles to include downsized vehicles as well as cargo/delivery bikes.
- U.S. EPA SmartWay Program Participation: Encourage carrier participation in SmartWay to promote environmental stewardship.
- Safety Strategies: General safety strategies for all modes and designated safety strategies for truck drivers and cyclists.

Pennsylvania E-Commerce Employment Profile

Key Takeaways:

- Industry-based economic statistics for e-commerce are difficult to measure using conventional data sources, because most Labor and Industry data do not distinguish e-commerce employment from traditional warehousing and transportation jobs.
- Between 2012 and 2022, retail employment in Pennsylvania decreased from 620,500 to 609,250—a reduction of about 1.8 percent.
- Conversely, employment in transportation and warehousing grew from 226,500 to 313,000 over the same period—an increase of more than 38 percent.
- U.S. Department of Labor Data for 2023 indicates that across the nation, the median hourly wage for Transportation and Warehousing industries is $23.64, which is nearly 40 percent higher than the $16.99 median hourly wage for the Retail sector.
- Employment at a sample set of e-commerce facilities in Pennsylvania is about 45 percent higher than a traditional warehouse/distribution center.
- An e-commerce facility has about 54 percent more employees per unit of floor area than a traditional warehouse.

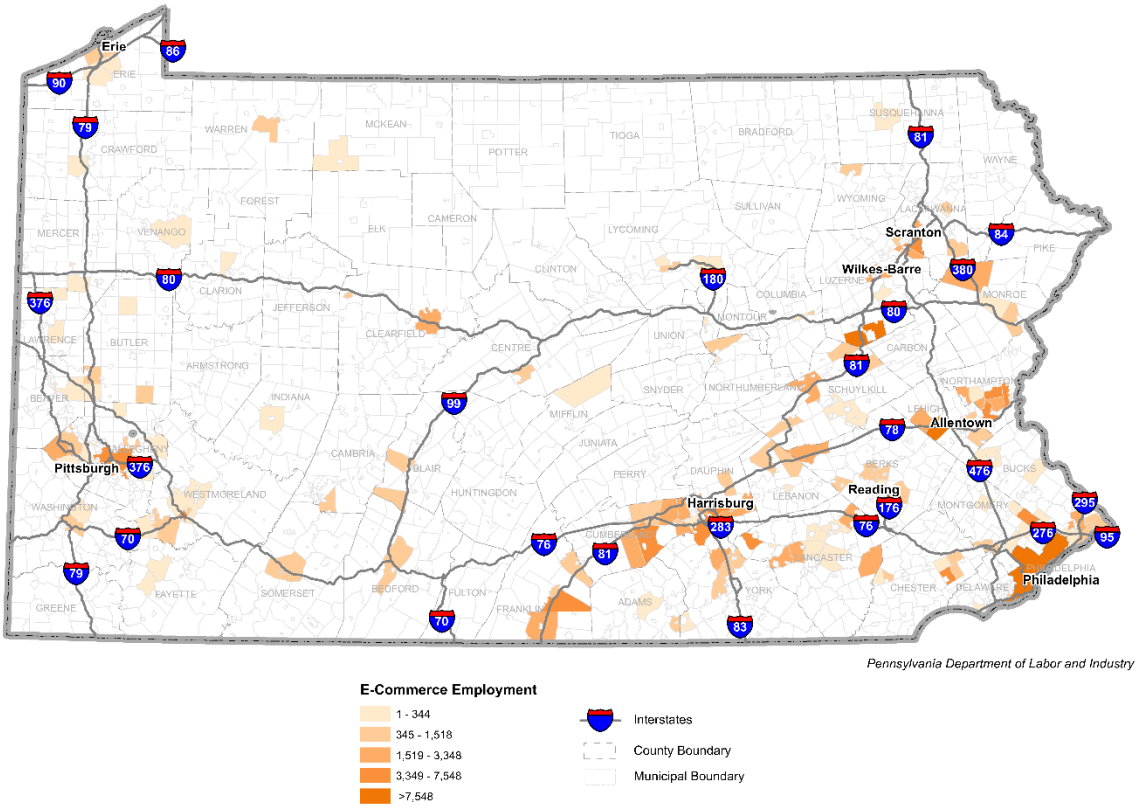
This section provides a profile of the state of the e-commerce industry in Pennsylvania—a starting point for assessing e-commerce as it relates to economic development and transportation.

Employment in Facilities Related to E-Commerce

The Pennsylvania Department of Labor and Industry (L&I) maintains statewide employment data in the public and private sectors across all industries. Figure 7 shows e-commerce employment at the municipal level for companies that have been so identified. These include Amazon, predominant general retail chains that engage in both traditional retail sales and e-commerce (Walmart and Target), and the two major companies engaged in overnight delivery services that support e-commerce retailers (UPS and FedEx).

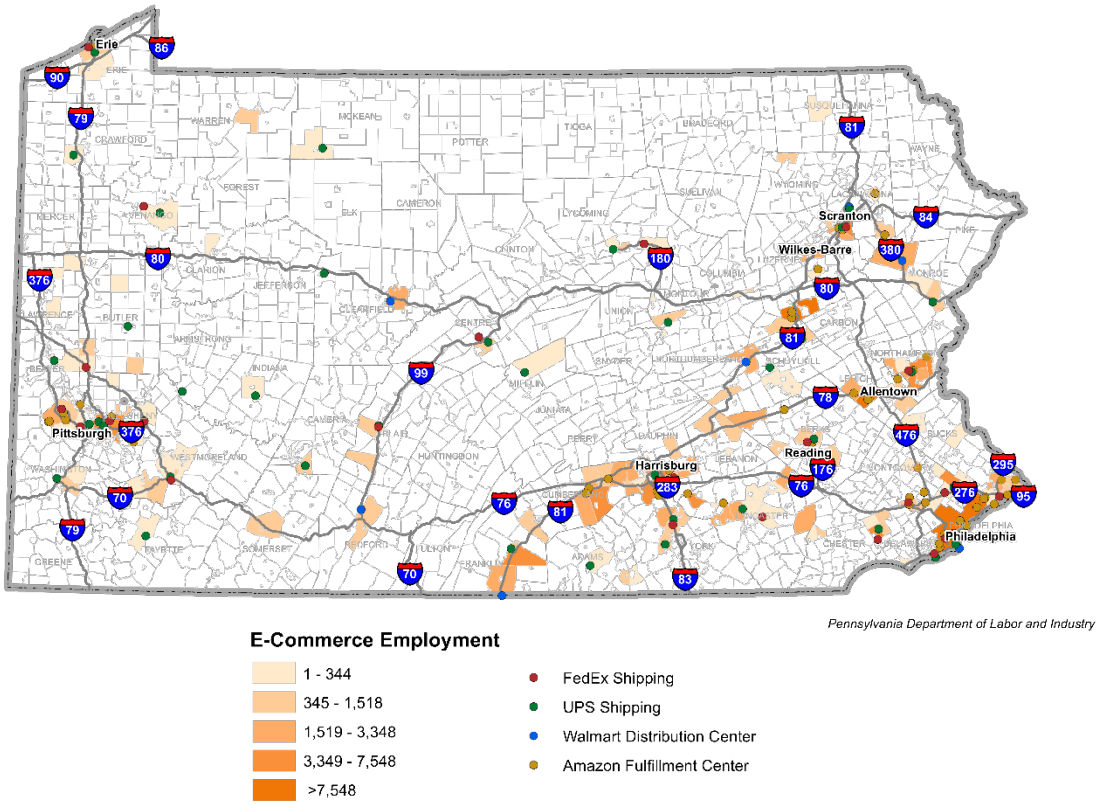
Figure 8 shows the actual locations of the facilities operated by these major players in e-commerce related industries, overlaid on the municipal-level map in Figure 7.[3] These facilities and the related e-commerce employment are scattered across the entire state, with notable concentrations in several areas, including the Philadelphia, Pittsburgh, and Harrisburg regions along with the I-78 and I-81 corridors in central and eastern Pennsylvania.

Figure 7: E-Commerce Employment Density by Municipality



[3] Figure 8 is the same as Figure 18 in the *Pennsylvania 2045 Freight Movement Plan* (Pub. 791, 5/2023)

Figure 8: E-Commerce Employment Density with Facility Locations



Pennsylvania Department of Labor and Industry

Industry Sector Statistics

One challenge in identifying e-commerce metrics is that most standard data sources used for these analyses cannot clearly distinguish between e-commerce deliveries and traditional retail sales. In general, the growth of e-commerce and the accompanying changes in "brick-and-mortar" retail activity can be seen through surrogate data organized by North American Industry Classification System (NAICS) industry codes. Employment and wage data for the Retail Trade sector is self-explanatory, whereas e-commerce activity is combined within the Transportation & Warehousing sector.

Pennsylvania employment figures for these two industry sectors are summarized in Table 1 for the 10-year period from 2012 to 2022. Employment in Retail Trade grew slowly between 2012 and 2017, then experienced a marked decline between 2017 and 2022. Closures of business establishments and other disruptions related to the COVID-19 pandemic played a major role in the decline. The drop in retail employment coincides with the dramatic increase in e-commerce activity as shown in Figure 6. Notably, there were fewer people employed in the Retail Trade sector in Pennsylvania in 2022 than there had been in 2012.

Conversely, the Transportation & Warehousing sector has enjoyed robust growth continuously from 2012 through 2022, with minimal impact from the COVID-19 pandemic. The 38.2 percent

growth in employment in this sector reflects an 18.6 percent increase from 2012 to 2017, followed by another 16.6 percent from 2017 to 2022. The figures for both the Retail Trade and Transportation & Warehousing sectors should be seen in the context of overall job growth across Pennsylvania over the period delineated in Table 1. Statewide, overall employment grew from 5.51 million in 2012 to 5.79 million in 2022—an increase of 5.0 percent.

Table 1: Pennsylvania Retail & Industrial Employment

NAICS Classification	Pennsylvania Jobs			2017 vs. 2012		2022 vs. 2012	
	2012	2017	2022	#	Pct.	#	Pct.
Retail Trade	620,515	629,432	609,260	+8,917	+1.4%	-11,255	-1.8%
Transportation & Warehousing	226,480	268,500	313,057	+42,020	+18.6%	+86,577	+38.2%

Source: U.S. Census Bureau, OnTheMap Application and LEHD Employment Statistics (2002-2022)

The changing employment characteristics in these two industry groups have important economic ramifications for Pennsylvania. Transportation & Warehousing sector wages tend to be substantially higher than Retail Trade. According to U.S. Department of Labor statistics for 2023, the national median wage for Transportation & Warehousing was $23.64, compared to $16.99 for Retail Trade.[4] While the Transportation & Warehousing figures do not directly reflect only e-commerce employment, they are indicative of overall trends in wage growth in commerce that involves the sale and delivery of goods and services. Wages are generally higher in transportation, warehousing, and distribution—the most critical elements of e-commerce—because these are the elements of a typical supply chain where the productivity gains among workers and the reductions of inventory costs over time have been most critical to the success of the companies that engage in the sale and delivery of merchandise to consumers and businesses.

Wages in the Transportation & Warehousing sector tend to be substantially higher than wages in the Retail Trade sector.

[4] U.S. Bureau of Labor Statistics, May 2023 National Industry-Specific Occupational Employment and Wage Estimates for Sectors 44-45 (Retail Trade) and 48-49 (Transportation and Warehousing).

Sample Pennsylvania Distribution Facility Profile

This study includes an analysis of a sample set of industrial facilities that include traditional warehouse and distribution centers as well as dedicated e-commerce fulfillment centers. A total of 17 facilities from across Pennsylvania were examined, with some degree of concentration in the areas and highway corridors described previously (see Figure 8 above). They were selected based on geographic location, industry type, and availability of data for the purpose of comparing important characteristics of their business operations. Characteristics used for comparison purposes include business type (traditional warehouse vs. e-commerce fulfillment center), building size, and employment level. Of the 17 facilities examined in this study, seven are e-commerce fulfillment centers and 10 are considered traditional warehouses or distribution centers.[5]

As the individual company names, locations, and employment figures were obtained from proprietary data licensed to the Pennsylvania Department of Labor and Industry (L&I), the information is presented here in summary format and not reported at the business establishment level. Building sizes were obtained using aerial photography from open-source resources (Google Earth®). This analysis focused on facilities with large building footprints, because they are generally the most prominent presence in most regions of Pennsylvania.

Findings of this profile analysis for the sample facilities include the following:

- The average warehouse included in this sample is about 6 percent larger than the typical fulfillment center.
- E-commerce fulfillment centers tend to be more labor-intensive than traditional warehouses. The average employment in an e-commerce fulfillment center is about 45 percent higher than in a warehouse (1,059 vs. 729 employees).
- Employment relative to building size is about 54 percent higher for a fulfillment center than for a warehouse. The average fulfillment center has 1.11 employees per 1,000 square feet of floor area, compared to 0.72 employees per 1,000 square feet for warehouses.
- The lowest employment counts among all the facilities in this sample are generally found in warehouses that handle retail merchandise with a long shelf life such as specialized consumer products, housewares, and auto parts.

One basic takeaway for public officials is not to group warehouses and fulfillment centers as one and the same—particularly bearing in mind the greater concentration of jobs in the latter.

[5] The L&I information does not distinguish between traditional warehouses and e-commerce fulfillment centers, and it is presumed that modern warehouses used by major retailers handle a mix of merchandise distribution to retail stores and e-commerce deliveries to homes and businesses. For this analysis, a "fulfillment center" is one that is operated by a dedicated e-commerce company (e.g., Amazon) or is identified as an e-commerce facility in the L&I data.

Package Delivery Fee Reassessment

Key Takeaways:

- A package delivery fee fits with the "user pays" principle and has potential for steady revenue growth. It could also be flexibly used to fund state and local transportation improvements.
- Colorado and Minnesota have adopted this funding mechanism and Maryland proposed such a fee in January 2025. Washington State is also considering adopting such a fee.
- Pennsylvania policymakers could consider a package delivery fee as one among other funding mechanisms to address the Commonwealth's transportation funding needs. It is not by itself a solution to Pennsylvania's transportation funding gap.

Reassessment of TROC Recommendations

In 2021, the Transportation Revenue and Options Commission (TROC) evaluated Pennsylvania's transportation funding needs and various funding options/sources to address the substantial unmet need. Figure 9 is an excerpt from that report showing the $9.35 billion state-level transportation funding gap and a local-level unmet need of $3.9 billion at that time.

A package delivery fee or goods delivery fee for e-commerce purchases was among the funding options considered and generally viewed favorably by the commission.[6]

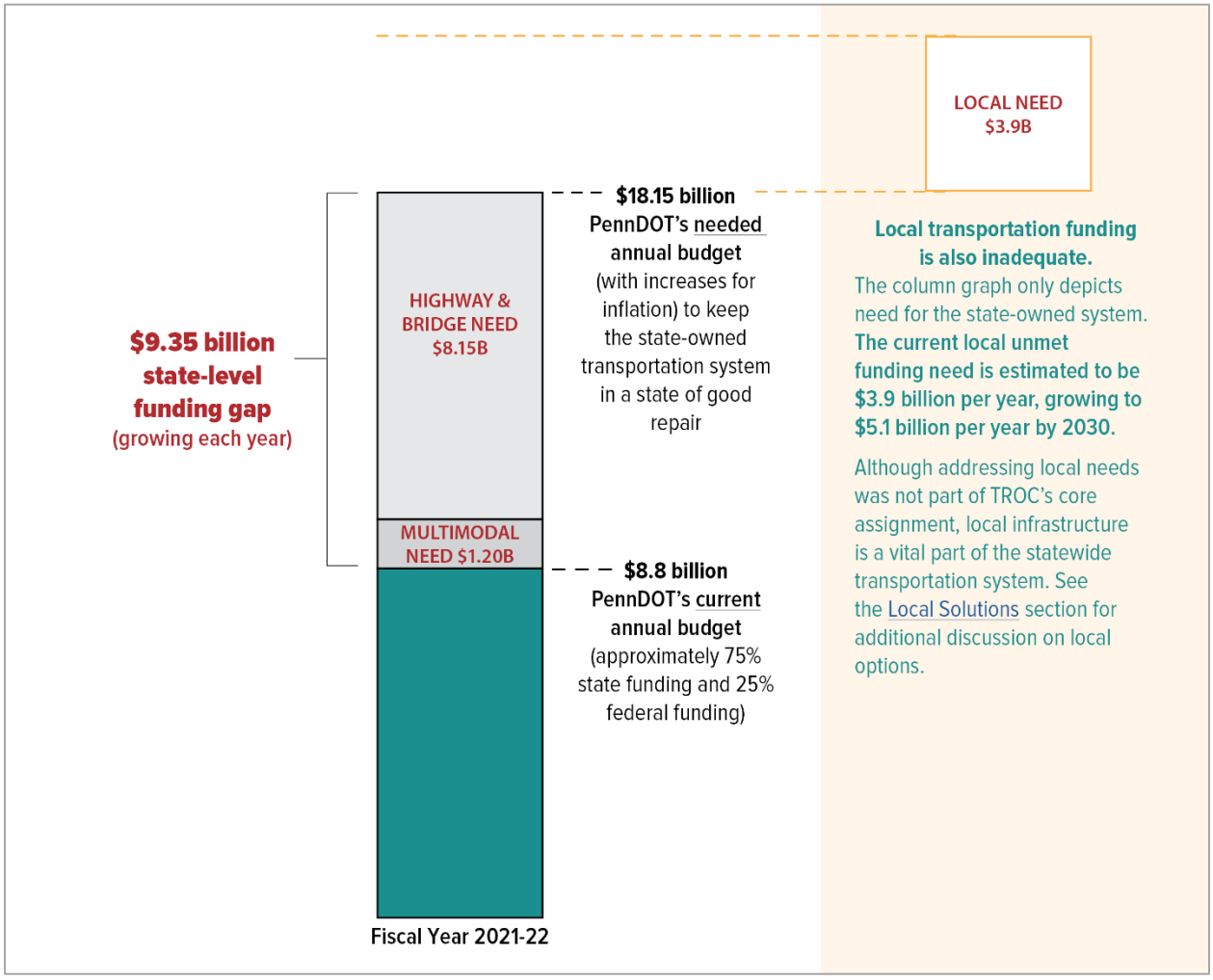
[6] https://www.pa.gov/agencies/penndot/about-penndot/transportation-funding/transportation-revenue-options-commission/troc-report.html

TROC's rationale included increased traffic on roads (particularly local roads), congestion, and infrastructure wear-and-tear. There was also recognition that other U.S. jurisdictions (Colorado and New York City at that time) were then actively considering a package delivery fee.

Later that year (in November 2021), the Congress enacted the IIJA/BIL law increasing transportation funding through a combination of formula funding to the states and competitive discretionary grants. The funding is helping Pennsylvania, but by no means represented a complete funding fix.

As part of this study, the TAC E-Commerce Task Force reviewed TROC's analysis retrospectively, with three years in the rearview mirror.

Figure 9: 2021 TROC Estimate of the Transportation Funding Gap



Source: Pennsylvania Transportation Revenue Options Commission Final Report, July 2021

Summary of TROC 2021 Analysis

The following points summarize how the TROC addressed the goods delivery fee concept.

- TROC evaluated the various funding approaches in relation to nine principles. Of those, the package delivery fee satisfies the Commission's principles of user pays, revenue base diversification, inflation indexing, and near-term feasibility.
- It was assumed that significant increases in package delivery volumes would impose greater maintenance and improvement costs on both the state and local road networks.
- Table 2 presents the cursory TROC calculations of potential package fee revenue, comparing the yield at different fee rates across five years, for retail parcels delivered to consumers and businesses.

Table 2: TROC Calculations of Potential Package Fee Revenue (in millions)

Fee Rate		$0.25	$0.50	$0.75	$1.00
Base Collections (2020)		$180.4	$360.8	$541.2	$721.5
	Growth Rate				
FY 2021-22	8.90%	$196.4	$392.9	$589.3	$785.8
FY 2022-23	6.02%	$208.3	$416.5	$624.8	$833.0
FY 2023-24	7.92%	$224.7	$449.5	$674.2	$899.0
FY 2024-25	7.99%	$242.7	$485.4	$728.1	$970.8
FY 2025-26	8.60%	$263.6	$527.1	$790.7	$1,054.3
Total		**$1,135.7**	**$2,271.4**	**$3,407.1**	**$4,542.8**

- TROC placed no restriction on the use of the estimated revenue generated by a package fee. This was viewed as a positive factor, allowing resources to be allocated or targeted for multiple modes, and for both state and local/regional needs.
- There is now wide recognition of the need for new funding sources that are flexible (as compared to the Motor License Fund revenue, which is not flexible in how it may be used). Local government representatives on the TROC emphasized that much of the e-commerce traffic occurs on Pennsylvania's local road network.

E-Commerce and Taxes in Pennsylvania

In assessing a package delivery fee, it is important to consider the tax structure under which e-commerce operates in Pennsylvania as it relates to transportation and sales tax.

In 2017, the Pennsylvania Legislature enacted Act 43 to update the Tax Reform Code, requiring large e-commerce companies to collect Pennsylvania sales tax on sales to Pennsylvania residents. Act 43 provided a framework for defining a variety of e-commerce business models, sales tax registration eligibility, and collection and remittance processes for e-commerce companies. Since

the act went into effect, well-known retailers and marketplace facilitators with online shopping platforms and home delivery options, such as Amazon, have been collecting Pennsylvania sales tax.

Following the 2018 landmark U.S. Supreme Court ruling in *South Dakota v. Wayfair*, in which the court held that states can require out-of-state sellers to collect sales tax for online purchases, the Pennsylvania Legislature passed Act 13 of 2019 to provide for out-of-state businesses with an economic presence in Pennsylvania. Act 13 defined economic presence for out-of-state sellers to include sellers making annual gross sales of $100,000 to Pennsylvania customers.

In addition to collecting sales tax, the supply chains fulfilling e-commerce logistics and last-mile delivery pay the transportation-related taxes and fees necessary to operate vehicle fleets in Pennsylvania. These include fuel tax, vehicle registration fees, Pennsylvania Turnpike tolls, and applicable alternative fuels tax. It is also worth noting that fees and penalties for parking violations are an everyday cost-of-doing-business expense for last-mile delivery companies in densely developed areas due to lack of loading zones and parking availability.

The transportation-related taxes and fees paid by the e-commerce industry support state and local transportation maintenance and construction projects, helping sustain the infrastructure the industry relies on to operate. In recent years, as vehicle-miles traveled in Pennsylvania have decreased and vehicles have become more fuel-efficient, revenue for transportation revenue has plateaued. Revenue is failing to keep up with inflation, which is worsening the longstanding transportation funding gaps. In 2021, the TROC report identified a $3.9 billion annual funding gap for local roads and bridges, a $1.2 billion gap for multimodal infrastructure, and an $8.15 billion funding gap for highways and bridges.

While the e-commerce industry contributes to Pennsylvania's transportation funding, there are overarching concerns about the state of transportation funding that affect the e-commerce industry along with all other transportation users. A package delivery fee would need to be part of a larger strategy for shoring up the Commonwealth's transportation funding system.

Package Delivery Fee Framework Explained

If Pennsylvania were to impose a package delivery fee, the exact details of its implementation would be subject to the authorizing legislation. Based on Colorado's retail delivery fee (further reviewed on page 63), this study envisions the following framework for how a package delivery fee could work in Pennsylvania.

Fee Imposition

Pennsylvania would impose a flat fee on retail delivery sales containing at least one item of tangible personal property subject to the state sales or use tax. The fee would be imposed per sale and collected by the retailer or marketplace facilitator responsible for collecting the sales or use tax—regardless of the party fulfilling the delivery, the number of packages delivered to fulfill the sale, or the number of separate deliveries made to fulfill the sale. Table 3 provides hypothetical examples of e-commerce purchases and how the package delivery fee would apply to items

subject to the sales tax. It is assumed that those items not subject to the sales tax would not be subject to the package delivery fee either.

Table 3: Examples – How Package Delivery Fee Would be Applied

	E-Commerce Order				
Purchaser	**Sales Tax Eligible Items**	**Sales Tax Exempt Items**	**Number of Packages**	**Number of Deliveries**	**Package Fee Charged?**
Individual	Lipstick, candles, flowers	T-shirts, tennis shoes	5	3	yes
Individual	None	Prescription medicine	1	1	no
Business	Box of highlighters, scissors	None	2	2	yes
Individual	None	Diapers	1	1	no
Individual	Burger, fries, and soda	None	1	1	yes
Individual	None	Milk, fruits and vegetables, frozen pizza, cereal, butter, ground beef	1	1	no
Tax-Exempt Non-profit	Sponges, towels	Bathroom tissue	2	1	no

Liability for Fee Collection

Any retailer or marketplace facilitator responsible for collecting sales and use tax on tangible personal property sold and delivered would be responsible for the collection of a package delivery fee, unless they qualify for an exemption. Pennsylvania, like Colorado, could create an exemption for small businesses that do not meet the existing threshold for collecting the Pennsylvania sales and use tax, or create a rebate or exemption to eliminate or reduce financial burdens for small businesses.

Retailers or marketplace facilitators responsible for collecting the package delivery fee could either collect the fee on all retail delivery sales and display the fee on the receipt or invoice separate from other taxes and charges, or elect to pay the fee on behalf of customers and omit the fee amount on receipts and invoices.

Fee Administration and Reporting

The Pennsylvania Department of Revenue (DOR) presumably would be responsible for administering the package delivery fee, in addition to its responsibility for administering the Pennsylvania sales and use tax. Retailers or marketplace facilitators required to collect the package delivery fee would register a package delivery fee account with DOR, and would file package delivery fee returns with DOR at the same time they file Pennsylvania sales and use tax returns. DOR would provide a standard form for the return, and a retailer or marketplace facilitator would file one return per registered account. Because a package delivery fee would

apply statewide, retailers or marketplace facilitators would not need to report sales by local jurisdiction.

Authorizing legislation following best practices for tax policy would provide for DOR to promulgate rules for full implementation, including penalty and interest provisions, refunds, auditing, appeals, and guidance for retailers and marketplace facilitators. It would also provide for DOR to adjust the package delivery fee for inflation on an annual basis, based on the Consumer Price Index, with sufficient notice to taxpayers.

Use and Distribution of Fee Revenue

The Pennsylvania Legislature would ultimately determine in authorizing legislation where to direct revenue from a package delivery fee.

In keeping with its stated purpose of addressing the impact of e-commerce on Pennsylvania's transportation system, revenue from a package delivery fee would likely be directed toward the transportation modes with the clearest connection to the industry and local jurisdictions working to accommodate the supply chain and last-mile delivery model. Note that the more purposes that are funded by any revenue source, the more its impact is diluted.

The Liquid Fuels Tax Fund is Pennsylvania's main instrument for funding local roads and bridges. Presently, 14 percent of Pennsylvania fuel tax revenue is allocated to local government through the Liquid Fuels Tax Allocation. Augmenting this fund with revenue from a package delivery fee would provide more adequate funding for Pennsylvania's more than 2,500 municipalities to maintain local streets, make improvements to accommodate increased deliveries, or make improvements to accommodate the traffic of nearby e-commerce fulfillment centers and warehouses.

A Multimodal Transportation Fund (MTF)—the Commonwealth Financing Authority MTF and/or the PennDOT MTF—would also be an appropriate fund from which to distribute package delivery fee revenue. These funds support grants for freight infrastructure needed to support e-commerce supply chains, as well as grants to local governments to support street improvements to accommodate complex challenges. Improvements to dense and commercial corridors to accommodate loading zones, Complete Streets designs, intersection and traffic signal optimization, and congestion relief strategies are common MTF-eligible projects in need of MTF grants that directly affect the e-commerce industry. Note that MTF funding requires the grant sponsor (typically a local government) to complete a detailed grant application, compete with other projects across the state for funding, and administer the grant in accordance with state requirements.

Conclusions

E-commerce will likely grow nationally and in Pennsylvania for the foreseeable future. The General Assembly and the Shapiro Administration could consider a package delivery fee as part of a broader approach to addressing transportation funding needs. Alone, it is not a panacea for addressing Pennsylvania's unmet transportation needs.

In that process the following should be evaluated:

- The total costs of administering such a program.
- The ease of collection and payment, simplicity of understanding such a program, and certainty in the compliance process.
- The ability to eliminate or reduce burdens for small businesses.
- The tax rate necessary to address an appropriate share of Pennsylvania's transportation funding needs.
- The benefits of e-commerce as part of the context for determining if this fee should be imposed and at what fee level, so as not to unduly hamper commerce or burden consumers. Those benefits include jobs and revenue, particularly for local municipalities and school districts.

TROC's assessment of a package delivery fee was made along with a wide range of other potential revenue sources, and therefore was considered as a concept with certain broad assumptions. There are several factors that warrant the Commonwealth's consideration of a package delivery fee at this time.

The growth of e-commerce deliveries during the COVID-19 pandemic generated greater public attention on the need for transportation infrastructure to address the challenges of accommodating traffic from fulfillment centers and congestion from last-mile distribution. New approaches to transportation funding are needed to bolster the fuel tax with its decreasing purchasing power.

At the same time, with the pandemic in the rearview mirror and a stabilized "new normal" of consumer behavior established, present-day revenue projections for a fee would be more accurate and predictable than they were in 2021. Growth in e-commerce is expected to continue for the foreseeable future and would translate into a revenue source that grows steadily and perhaps at a greater rate than other revenue sources.

Finally, other states have successfully authorized and implemented similar fees since the TROC report and are able to share lessons learned and best practices. The following section explores similar fee programs across the United States.

Other States' Experience with a Package Delivery Fee[7]

Colorado

- **Overview**: Colorado was the first in the nation to enact a retail delivery fee as part of a broader transportation funding package. The fee, which went into effect on July 1, 2022, was 27 cents at the time of enactment and is applied to retail deliveries by motor vehicle that include at least one item subject to state sales or use taxes. The fee is reevaluated and updated each state fiscal year and is currently 29 cents. Colorado has a population of 5,773,714 with a median household income of $92,911,[8] compared with Pennsylvania's population of 13,002,700 and median household income of $73,824.[9]

- **Lessons Learned**: In 2023, one year after going into effect, the fee was raised from 27 cents to 28 cents and the Colorado General Assembly amended the fee's enabling legislation (§43-4-218, Colorado Revised Statutes) after receiving feedback from the business community. As a result, small businesses ($500,000 or less in annual sales) became exempt, and retailers were provided additional choices in fee collection.
- **Transaction Exemptions:** In addition to the small business exemption described above, transaction-based exemptions include online orders picked up from a retailer's business location, deliveries to locations outside of Colorado, wholesale sales to licensed retailers for the purpose of resale, and deliveries made entirely without use of a motor vehicle.
- **Revenue Generation:** In its first fiscal year (2022-23), Colorado's retail delivery fee generated $75.9 million in revenue. In FY 2023-24, revenues increased to $92.8 million (~$7.8 million per month). The Colorado Department of Revenue projects that the state's transportation system will accommodate approximately 501.8 million deliveries in 2030 (or ~1.3 million deliveries daily).
- **Revenue Distribution:** Revenues generated from the state's retail delivery fee are used/distributed among several major purposes: electric vehicle infrastructure

[7] At the time that this study was being finalized, Maryland announced a proposal for a package delivery fee: https://www.thebaltimorebanner.com/politics-power/wes-moore-maryland-delivery-fee-NLWEW65MPFCZBLV7AHJW45M4CM/

[8] U.S. Census Bureau, Colorado – Census Bureau Profile

[9] U.S. Census Bureau, Pennsylvania – Census Bureau Profile

(Community Access Enterprise), electrification of transit (Clean Transit Enterprise), the Highway Users Tax Fund (HUTF), the Multimodal Transportation Options Fund (MTOF), bridge projects/surface transportation projects for tunnels (Bridge and Tunnel Enterprise), and air pollution mitigation in non-attainment areas (Air Pollution Mitigation Enterprise).

Minnesota

- **Overview**: Minnesota's "retail delivery fee" (also referred to as the "Road Improvement and Delivery Fee") went into effect on July 1, 2024, as outlined in Chapter 168E of the Minnesota Statutes. The 50-cent fee is paid by retailers/sellers and applies to retail transactions of $100 or more involving delivery. Goods taxed are any tangible personal property subject to sales tax, and clothing purchases. Deliveries by third-party shippers, couriers, and those using company vehicles are also subject to the fee. Minnesota has a population of 5,706,494 with a median household income of $85,086,[10] compared with Pennsylvania's population of 13,002,700 and median household income of $73,824.[11]
- **Fee Exemptions**: Like the fee imposed in Colorado, Minnesota exempts small businesses/retailers. Specifically, the statute defines a small business as a "retailer with retail sales totaling less than $1 million in the previous calendar year or a marketplace provider that facilitated retail sales of less than $100,000 in the prior calendar year." The fee also does not apply to retail delivery transactions related to the retail sale of food, beverages, drugs, medical supplies/devices, and baby products.
- **Potential Revenue Generation**: The intent of the fee is to generate additional revenue for state infrastructure projects and other public services. Within its first fiscal year, the fee is expected to generate approximately $59 million in revenue. In general, Minnesota's experience in implementing the delivery fee is in its infancy at the time of this writing and data regarding its full impact is limited.

Washington

- **Overview**: The State of Washington had not enacted a retail delivery fee at the time of this writing, but is exploring the possibility of enacting a measure like those in Colorado and Minnesota to address a backlog of roadway maintenance needs. In response to State HB 1125, the Washington State Joint Transportation Committee in June 2024 published a report on possible impacts and potential revenue generation/distribution of a retail delivery fee.
- **Potential Revenue Generation**: Using several inputs (e.g., fee rates, growth in retail sales, adoption of e-commerce, potential exemptions), the analysis examined potential revenue generation of a potential 30-cent delivery fee across four scenarios, summarized

[10] U.S. Census Bureau, Minnesota – Census Bureau Profile
[11] U.S. Census Bureau, Pennsylvania – Census Bureau Profile

in the table below. A preferred scenario was not identified; however, each scenario generated varied results using the following parameters:

- Scenario 1: Baseline, no exemptions to retailers or by order value
- Scenario 2: Exempts orders below $75
- Scenario 3: Exempts retailers with gross revenues under $1 million
- Scenario 4: Exempts orders below $75 and retailers with gross revenues under $1 million

Figure 10: Washington State Delivery Fee Revenue Potential by Scenario

Table ES-1. Revenue Potential

	Scenario 1 (Baseline)	Scenario 2	Scenario 3	Scenario 4
Delivery Fee Amount (per order)	$0.30	$0.30	$0.30	$0.30
E-commerce Adoption Rate Assumption	Steady	Steady	Steady	Steady
Exemptions for Retailers	None	None	Businesses with gross revenues of $1 million and less	Businesses with gross revenues of $1 million and less
Exemption for deliveries of orders under $75	No	Yes	No	Yes
Projected Annual Revenue (2026)	$103M–$112M	$49M–$54M	$93M–$102M	$45M–$49M
Projected Annual Revenue (2027)	$110M–$123M	$53M–$59M	$101M–$112M	$48M–$54M
Projected Annual Revenue (2028)	$118M–$135M	$57M–$65M	$108M–$123M	$52M–$59M
Projected Annual Revenue (2029)	$126M–$147M	$61M–$70M	$115M–$134M	$55M–$64M
Projected Annual Revenue (2030)	$135M–$160M	$65M–$77M	$122M–$145M	$59M–$70M

Assumptions: The fee was not adjusted for inflation over the forecasting period, and revenue growth is expected as e-commerce continues to gain traction.

Source: *Retail Delivery Fee Analysis*, CDM Smith for the Washington State Joint Transportation Committee, June 2024

- **Implementation Considerations**: Assuming an effective date of January 1, 2026, CDM Smith (consultant to the Washington State Joint Transportation Committee) assumes that the Washington Department of Revenue would be the administrator of the retail delivery fee program. The analysis also projects that the costs behind administration would begin at nearly $205,000 in FY 2025 in advance of the enactment, peaking at $504,900 in the first fiscal year (2026), and leveling out to $159,400 annually beginning FY 2028.
- **Revenue Distribution**: CDM Smith's analysis assumes that total revenue would be divided among the state and its localities (counties, cities, towns) to address state and local transportation infrastructure maintenance and repair. Potential revenue shares to each locality were estimated based on several criteria, including population, miles of roadway, traffic volumes (VMT), and portion of e-commerce sales.

Local Land Use Planning and Zoning

Key Takeaways:

- Accommodation of e-commerce facilities should be accomplished in tandem with sound local planning practices addressing transportation, economic development, environmental, and quality-of-life matters. Key stakeholders, especially e-commerce industry representatives, should be involved to ensure an understanding of its unique requirements.
- Present tools and zoning practices are outdated in relation to e-commerce and land use/development patterns and facility requirements.
- There is a timely opportunity for the Commonwealth to develop guidelines and tools for appropriate accommodation of e-commerce—with the input of all key stakeholder segments.

This section was informed in part through a hands-on workshop involving two members of the TAC consultant team with combined expertise in transportation policy, transportation planning, and community planning, and a subject-matter expert from the real estate industry located in York County. That area is experiencing great demand for e-commerce and warehousing facility development, primarily along the I-83 corridor. The workshop was structured to address a wide range of e-commerce topics in relation to community land use planning and regulation—combining the respective subject-matter expertise of the participants.

Land Use Implications of E-Commerce

The transition from traditional retail sales to e-commerce has implications for community land use. Suburban shopping centers and retail stores in downtown areas have had to contend with changing customer purchasing habits, resulting in fewer direct sales and a decline in customer foot traffic. Smaller independent stores struggle to compete with the online dominance of major e-retailers such as Amazon.

Under a worst-case scenario, dwindling retail store activity results in high vacancy rates in commercial properties and closures of retail centers.

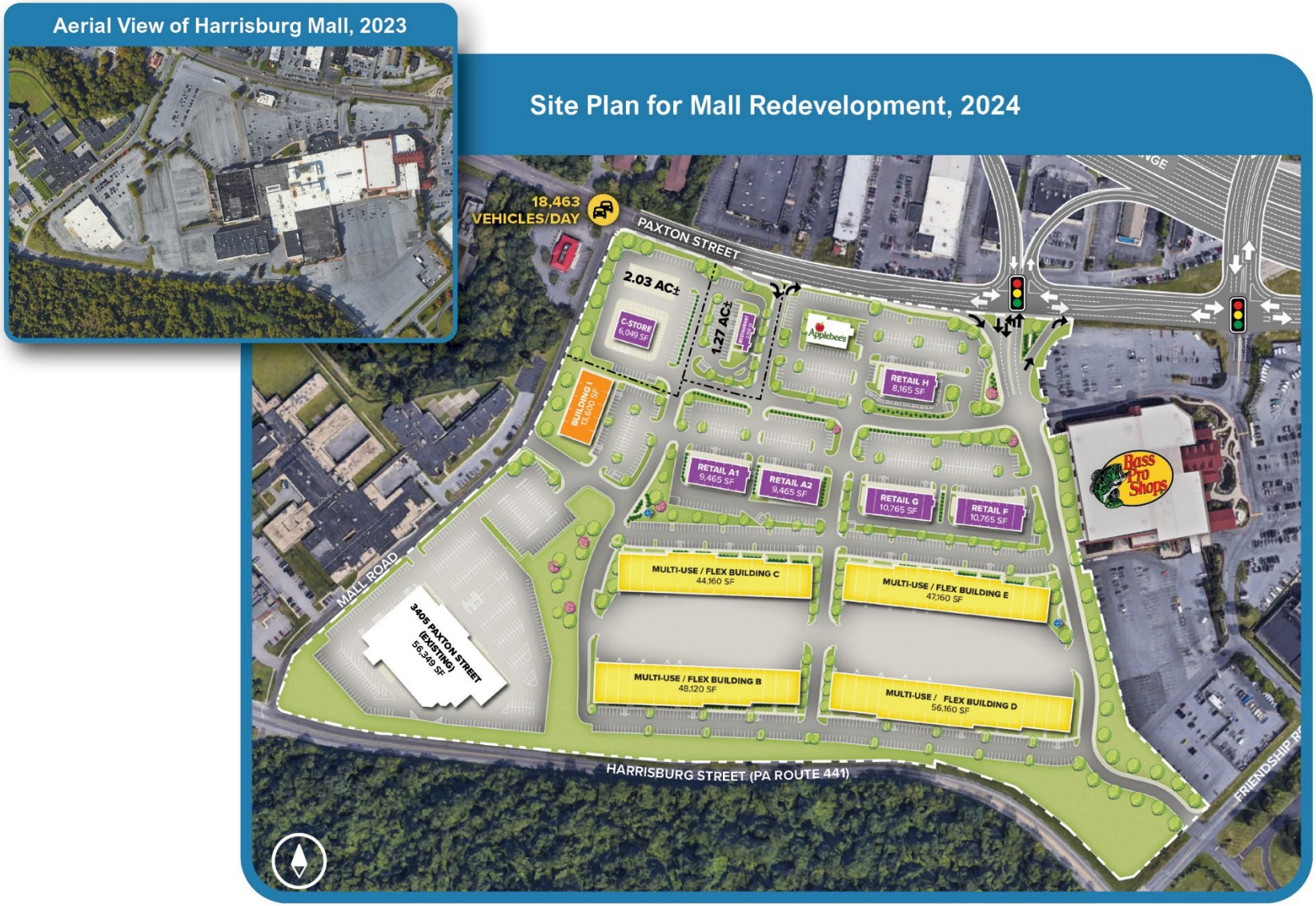
Alternatively, to adapt to e-commerce, some property owners and municipal officials have successfully transformed traditional retail centers into mixed-use developments designed to accommodate more restaurants, service-oriented business establishments, and office uses that do not face the same competitive pressure from e-commerce as do retail stores. As a contextual aside, this adaptation is responsive to the public's desire for community and connection that has rightly been receiving more attention nationally in the transportation and land use dialogue.

One example of these changes in land use is presented in Figure 11. The redevelopment of the Harrisburg Mall site (in suburban Harrisburg, PA) exemplifies one of the defining characteristics of e-commerce: the elimination of the retail store in the business-to-consumer and business-to-business supply chain for many types of merchandise.

The Harrisburg Mall opened in 1969 and is typical of suburban shopping centers built in the 1960s and 1970s. Having drawn customers away from downtown stores, it suffered its own decline in subsequent decades with the loss of anchor stores and shifting shopper preferences. The mall closed in 2024. A developer is demolishing most of the mall and replacing it with smaller detached buildings for a variety of uses.

The changes at the Harrisburg Mall reflect the transition in the e-commerce era from large shopping malls to mixed-use centers where department stores from the post-WWII era are slowly being replaced by smaller specialized stores and a mix of uses including restaurants, convenience stores, office/flex space, and other types of business establishments.

Figure 11: Land Use Changes at the Harrisburg Mall



As retail stores have faded in importance, development of warehousing and fulfillment centers has surged in many areas. The shift offers some opportunities and potential impacts to communities, discussed in the following section.

Planning and Zoning Considerations

Transportation and land use must be considered together as part of the public sector's assessment of how best to support e-commerce while managing its impacts to transportation infrastructure, and where and how facilities are developed. Zoning is the responsibility of the municipality, while roads and bridges may be state-owned or locally owned.

The purpose of zoning is to manage land use by permission for the benefit of public health, safety, and welfare. For many municipalities, zoning ordinances were developed decades ago, when patterns of shopping and distribution, travel demand, and residential development were significantly different than they are today. New land uses and activities continue to emerge, with new technologies incorporated into building systems and construction.

The purpose of zoning is to manage land use by permission for the benefit of public health, safety, and welfare.

Zoning ordinances should be updated periodically to define and incorporate permissions and use-specific standards for new land uses (as supplementary regulations). The update process is both technical and administrative. It entails legal document preparation and review, along with public notice and public comment. Particularly for smaller municipalities, the formal update process tends to be deferred until there are multiple reasons to update the ordinance.

Warehouses are commonly defined and addressed in municipal zoning ordinances; however, different facility types may be similar in size and layout but serve different functions in a supply chain. The two primary building types as they relate to a modern supply chain are as follows:

- The terms **warehouse** and **distribution center** are often used interchangeably. Warehouses had historically been used for long-term bulk product storage, but have evolved over time and now function as buildings where pallets of products are broken down and re-grouped for regional distribution, primarily by truck, to retail outlets or fulfillment centers. They are typically large, often single-story buildings. Modern distribution centers often exceed one million square feet in floor area. There are relatively few employees supported by operations that have become increasingly automated over time, and therefore present a small employee parking load, and relatively low water/sewer demand. They are characterized by considerable inbound and outbound large/heavy truck traffic, many loading docks, and trailer parking, which translates to considerable impervious pavement (and the need for stormwater management), truck noise, and air quality impact. Proximity to major highways is important.

- **Fulfillment centers** are typically large buildings dedicated to handling e-commerce shipments. The larger ones are comparable in size to a modern distribution center as described above, but smaller facilities in the range of 50,000 to 150,000 square feet may be located in more urbanized areas where available land is scarce. They are often single-story but may be multi-story; internal freight handling has evolved and become more automated. They require more employees for individual order picking and packing, and therefore a larger employee parking lot, greater need for stormwater management, and have a higher water/sewer demand than warehouses or distribution centers. Proximity to a suitable workforce is important. Truck traffic comprises both large/heavy trucks (primarily on inbound deliveries) as well as smaller trucks and delivery vans (for outbound deliveries to customers). There are generally more vehicle trips associated with outbound freight due to the nature of most e-commerce deliveries and smaller loads, contributing to traffic, noise, and air quality impacts. Proximity to a metropolitan area's transportation network is important.

Both land use types should be supported by on-site or nearby truck parking/staging facilities.

The Municipalities Planning Code (MPC) requires that municipal zoning ordinances allow for every use. Therefore, every zoning ordinance should permit fulfillment centers while managing that land use and its impacts to avoid a zoning challenge.

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Potential Strategies for Addressing Land Use

PennDOT and DCED should collaborate with Pennsylvania's MPOs/RPOs and local government associations to strengthen planning and zoning to effectively manage e-commerce development. E-commerce industry stakeholders should also provide input in carrying out efforts such as those that follow.

- **PennDOT and DCED should help local communities understand the location factors associated with e-commerce development.**
  Certain municipalities and certain sites within those municipalities may be especially attractive to e-commerce developers. Factors such as a region's location, transportation access, land cost, availability of appropriately zoned land, proximity to an available workforce, and tax considerations all affect the prospect that a municipality could be facing e-commerce land use decisions at some point. Advance planning and consideration of associated opportunities and issues enables a local government to better balance the costs and benefits of e-commerce activity for its residents.

- **PennDOT and DCED should develop practical tools to support MPOs/RPOs and local governments to effectively plan and zone for e-commerce.**
  This could take the form of a handbook offering guidance on local land use planning and zoning modernization. The intent would be to alert users—especially those in smaller municipalities without in-house planning capabilities—to the types of topics and questions they should be considering and the importance of keeping zoning current. It would aim to assist local government leaders in decision-making to maximize the positive aspects of e-commerce (e.g., good jobs, tax base expansion) while minimizing or mitigating potential negative impacts (e.g., traffic, noise, air quality, loss of agricultural land, wear-and-tear on roadways).

  While model ordinance language should be included as practical assistance to local governments, the guidance must be flexible—one size does not fit across Pennsylvania's more than 2,500 municipalities.

  While PennDOT and DCED would lead development of such a handbook, the guidance should be prepared collaboratively with representatives of the public and private sectors, including e-commerce industry representatives, municipal associations, and experts in economic development and various transportation modes. The intent would be to encourage robust discussion and achieve a practical, balanced tool.

One avenue for promoting the use of the handbook could be through the PennDOT Connects process, where state, regional, and local representatives convene to discuss and coordinate upcoming transportation projects.

- **Consider updating the Municipalities Planning Code.**
  For years there have been calls to update Pennsylvania's Municipalities Planning Code (MPC). Should that occur, there is an opportunity to address e-commerce-related planning and zoning matters. It is possible that from a timing perspective such an update could occur in conjunction with the development of the planning guidance and handbook that the TAC is recommending. The two efforts could have mutual benefit.

E-Commerce and Environmental Justice

Key Takeaways:

- Environmental Justice (EJ) has been a focus for transportation planning and project development. A scan of the literature indicated that this topic is being considered in other states.
- Because of the relative newness of e-commerce in relation to state and local government, the TAC saw the need to raise basic questions about EJ as it relates to e-commerce.
- There are numerous considerations that apply to environmental justice that can be addressed through state and regional transportation planning and community planning.

Background

On November 12, 2024, the TAC consultants met with PennDOT staff representing Policy, Planning, and Equal Employment Opportunity. The purpose was to explore potential implications of e-commerce from an environmental justice (EJ) perspective.

An earlier cursory literature review identified related research on e-commerce and EJ, including:

- Transportation Research Board: https://trid.trb.org/View/2304549
- *Transfers Magazine* (transportation research for the Pacific Southwest region): https://transfersmagazine.org/magazine-article/issue-6/bearing-the-brunt-of-expanding-ecommerce/

U.S. Environmental Protection Agency Definition of 'Environmental Justice'

"Environmental justice" means the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people:

- are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and
- have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices.

While federal policy and priorities change with each presidential administration, the emphasis on fair treatment of all communities endures, including efforts to maximize benefits and minimize impacts of e-commerce.

EJ Considerations for Transportation and Land Use

The points below are to suggest that any future public-sector efforts to support e-commerce continue to be mindful of environmental justice considerations and opportunities.

1. **E-Commerce and Public Sector Transportation/Land Use in Relation to Public Policy** – Title VI of the Civil Rights Act (prohibition of discrimination) is a foundational law that must be considered regarding public programs and projects to, among other things, consider any disproportionate impacts on EJ populations.
2. **E-Commerce Assessments** – EJ assessments in relation to e-commerce should consider as applicable:
    - Warehousing is generally in suburban areas, and well-resourced communities may be better able to resist such development or to ensure that it satisfies community concerns. As such, attention should be given to how such development might impact EJ communities—positively or negatively.
    - The potential impacts of truck traffic and emissions.

- Mode shift resulting from new purchasing and distribution patterns—consumer trip-making changes—driving, walking, public transportation, bicycling.
- Impacts to "Main Street" businesses, which are typically within walking distance of EJ communities. Their closure/dislocation due to an e-commerce shift could have adverse impacts on EJ individuals being able to access essential goods and services.
- The transportation services needed to provide access to jobs at potentially longer distances for historically disadvantaged populations. Public transportation may be a key part of the jobs–labor pool connection.
- Quality of jobs and access and opportunities for obtaining employment. Economic assessments should attempt to quantify jobs gained vs. jobs lost for historically disadvantaged populations. TAC's research has shown that e-commerce employment tends to compensate better than traditional retail jobs.
- The stressors on disadvantaged communities in relation to the full range of e-commerce impacts. This entails the ability to consider both transportation impacts along with broader system considerations.
- Systemic solutions such as zoning for warehouse locations. (EJ should be kept in view when preparing the local guidance and tools that are included in this report's recommendations.)

3. **E-Commerce Benefits** – Many individuals in EJ communities may benefit from home delivery, particularly those without cars, medically vulnerable individuals, and those with limited mobility. Commercial shipping costs or expensive subscription plans for "free" delivery pose a barrier to EJ communities in poverty accessing e-commerce.
4. **Advisory Resources** – PennDOT and others can leverage the advisory resources of the various commissions to the Governor that work with EJ populations and with the Pennsylvania Department of Environmental Protection's Office of Environmental Justice and Environmental Justice Advisory Board.
5. **Waste Streams** – It is a concern that the waste stream of e-commerce, like other sectors, could have a disproportionate adverse impact on EJ populations. E-commerce's effect on municipal waste and recycling tonnage should be studied, and cost recovery with e-commerce waste is a matter deserving attention. Cost recovery is the process of recouping some or all of the costs associated with managing and recycling electronic waste generated by online shopping.
6. **Public Participation** – EJ communities need to have a voice in e-commerce matters impacting them. The communities are sometimes under-represented in local government and less likely to deal with PennDOT directly, which may mean that advocacy groups need to serve as the voice for these communities.

Potential Strategies for Addressing Environmental Justice

- PennDOT noted that e-commerce could be considered as part of the Department's current strategic planning for EJ, expected to be completed in 2025.
- Access to e-commerce should be considered for future assessment and as a potential performance measure.
- Limited English Proficiency (LEP) – Meaningful access to services and vital documents is a priority and would apply to future PennDOT efforts related to EJ.

Findings

Many of the study findings draw on stakeholder input from the MPO/RPO survey and the TAC e-commerce expert panel virtual meeting. There is not a one-to-one relationship between the findings and the recommendations that appear in the next chapter. This in part reflects that this study is as much educational as it is actionable.

Transportation Demand and Operations

1. **E-commerce trends, accelerated by the COVID-19 pandemic, have altered transportation demand in ways that need to be better understood.**
   Since the pandemic, reductions in commuter and other passenger vehicle traffic have been observed due to more people working from home and fewer people driving to shop for goods at brick-and-mortar stores. Conversely, increases in freight traffic have occurred. Several MPOs/RPOs noted an increase in traffic on their region's Interstates, other limited-access highways, and lower-tier roadways. Other observed impacts of increased freight traffic include:

   - Increased traffic congestion and the need for more frequent road maintenance.
   - Commercial trucks and larger delivery vehicles sometimes using routes not designed for heavy trucks for travel between e-commerce facilities and major highways.
   - The need for additional and expanded truck parking and staging facilities to avoid roadside issues.
   - Increased demand for landside traffic/connections off airport property as deliveries make their way to their next destination. Increases in air freight traffic related to e-commerce (UPS, FedEx, Amazon PrimeAir) were mentioned by several regions whose transportation networks include commercial service airports (e.g., Philadelphia, Lehigh Valley).

2. **E-commerce seems to have a disproportionate impact on the local transportation system, while its overall impact on transportation across a regional scale appears to be minimal.**
   Pennsylvania's vast local roadway network is now handling a sizable volume of commercial vehicle traffic that in many cases it was not designed to accommodate. By its nature, e-

commerce generates a high volume of individual deliveries, leading to more commercial vehicles on local roadways. The last leg of delivery, commonly referred to as the "last mile," typically represents the delivery segment with the highest cost, because it is the most labor-intensive relative to the volume of merchandise that is being handled. E-commerce orders are often delivered as single items or small packages, which can require multiple delivery trips to multiple locations, sometimes within the same neighborhood, contributing to traffic congestion.

The rise of same-day or next-day delivery can lead to more frequent deliveries, putting further pressure on roadway networks. Conversely, consumers receiving e-commerce deliveries are likely making fewer shopping trips to traditional retail establishments. This finding has a bearing on the topic of a package delivery fee (see page 56).

Some planning regions have observed increases in medium- and heavy-duty freight trucks driving on local roadways that were not designed to handle the size or weight of these vehicles. Large, heavy trucks traveling through small towns have also resulted in congestion issues; this is likely to be driven by general growth in freight activity and is not specific to e-commerce. Roadways in rural areas are often not suited to commercial delivery traffic, with limited shoulders and inadequate driveways being characteristic of delivery destinations.

As some regions see more e-commerce/fulfillment/warehousing developments occurring farther away from limited access highways and principal arterials, traffic will shift to minor arterials and major collectors. This could have repercussions for congestion, maintenance, and traffic safety.

Some MPOs/RPOs noted local governments experiencing the strain that increased delivery traffic is having on their roadways, but struggle to find the funding (local match) to maintain or upgrade their local road infrastructure to keep pace with e-commerce's impacts.

3. E-commerce has implications for street operations and design, including in dense urban centers (e.g., double parking with congestion and safety risks).

The combination of high service frequency and smaller shipment size (compared to traditional bulk truck deliveries to retail stores) complicates street function. Delivery vehicles must now be considered as another regular road user along with passenger vehicles, large trucks, public transit, pedestrians, and cyclists.

Delivery vehicles must now be considered as another regular road user along with passenger vehicles, large trucks, public transit, pedestrians, and cyclists.

In addition to the added traffic volume, there are new implications for curb access and sidewalk space for handling deliveries. The state's more urban areas highlighted growing competition for curbside space resulting from increases in delivery vehicle traffic (e.g., UPS,

FedEx), larger trucks making business deliveries, and third-party delivery companies such as DoorDash and Uber Eats.

In short, e-commerce delivery heavily influences road usage, and street design and operations must adapt. There may be ways in which e-commerce stakeholders can interface with the public sector to better manage transportation system capacity via technology-driven information exchange. Of course, efforts to maximize throughput for the e-commerce industry should complement efforts to enhance transportation system performance for all users.

4. **Few of the state's MPOs and RPOs have conducted specific studies or analyses related to e-commerce; however, many have regional freight plans and continue to monitor e-commerce.**

DVRPC has completed several e-commerce studies and analyses through various lenses, ranging from goods movement and strategies for the region's retail districts to issues associated with the digital divide. DVRPC's work includes a regional Impacts of E-Commerce report, the Philadelphia Truck Network and Complete Streets Integration Guidebook, the Philly Freight Finder tool, a Halo Effect Webinar, and its Cultivating a Homegrown Economy report. The MPO has additional products in development including an updated retail district inventory and an analysis of transportation and warehousing occupational growth.

Although not strictly centered on e-commerce, the York MPO has developed a countywide freight plan and established a Freight Advisory Committee. It has also conducted an inventory of warehousing and similar land uses throughout the county. Similarly, five of the state's MPOs (Lackawanna-Luzerne, Lebanon, Lehigh Valley, NEPA, and Berks/Reading) are working together as the Eastern Pennsylvania Freight Alliance to adopt and implement a regional freight plan. Other planning partners noted that they continue to implement their previously developed freight plans. These regional forums hold promise for future efforts to address e-commerce across the Commonwealth—particularly by engaging the full range of key stakeholders.

Several MPOs and RPOs expressed the lack of effective engagement with private freight interests, including those related to e-commerce, as a barrier to community/transportation planning. Similarly, many local governments do not have the institutional capacity to become experts on topics like e-commerce before related issues become a pressing matter.

5. **E-commerce facilities will likely require expanded public transportation access for workers.**

E-commerce fulfillment centers typically require more employees than conventional warehouses, due to the handling required for individual orders. The jobs typically pay a good wage, providing opportunities for many Pennsylvanians. There may be the need to consider the varied workforce access implications including public transportation service, shift work, and proximity of the fulfillment centers to residential and urbanized areas. Geographically, in many instances these facilities are in areas not readily accessible via fixed-route public

transportation service. (Concurrent with this study, the TAC addressed the transportation workforce implications of various trends, including e-commerce. The report is slated for release in April 2025.)

Employment and Economic Development

6. E-commerce generates substantial employment and economic benefits that need to be considered for balanced public policy affecting the industry.

E-commerce is labor-intensive, and typically combines the attractive characteristics of competitive hourly wages and flexible work schedules for 24-hour operations. E-commerce facilities also provide property tax revenue for local municipalities and school districts. Policymakers need to consider both the benefits and costs associated with e-commerce in formulating sensible approaches. This includes the need to sort out public/private benefits and costs: balancing costs of offsite improvement needs and the benefits of property tax revenue that are generally shared between municipal governments and local school districts.

7. Warehousing and fulfillment center employment generally yields a greater economic benefit to regions than traditional retail employment.

U.S. Department of Labor Data for 2023 indicates that the national median hourly wage for Transportation and Warehousing industries is $23.64, which is nearly 40 percent higher than the $16.99 median hourly wage for the Retail sector. This reflects the higher demand for more skilled labor at intermediate steps in a supply chain.

8. Major e-commerce companies pose competitive challenges for traditional small businesses and downtown vitality.

E-commerce's growing share of total retail sales, in addition to the competitive prices and convenience of e-commerce services, increases competitive pressure on many brick-and-mortar stores and local business. Many cannot ultimately compete, leading to business closures and increased building vacancy rates and a reduction of local economic activity. The loss of local stores also has equity implications, as some populations may be more dependent on physical, brick-and-mortar businesses/services (e.g., hardware stores, local markets, etc.). TAC expects this economic shift to continue. For PennDOT and other transportation organizations, this will require adapting transportation projects, programs, and services, as has been the case throughout history as transportation supports an ever-changing economy.

Land Use

9. E-commerce has contributed to the decline of traditional retailing, the repurposing of malls and shopping centers, and increased development of fulfillment centers.

Many MPO/RPO regions are seeing retail spaces like shopping malls and standalone brick-and-mortar retail establishments being repurposed for e-commerce-oriented uses. Nearly all regions mentioned an increase in warehousing and fulfillment center construction, sometimes

on sites miles away from limited-access roadways and other major corridors. The facilities may involve redevelopment of existing buildings or the conversion of agricultural land into industrial centers.

Decreased local tax revenue from job losses and closure of brick-and-mortar businesses will impact the ability to fund infrastructure improvements, while the increased strain on regional transportation networks will require the need for more maintenance and repairs. The geography of tax revenue may be particularly challenging as revenues shift from the locales that lost businesses to those gaining e-commerce facilities.

10. Planning and zoning need to be modernized through a proactive, collaborative approach among public and private stakeholders.

Municipal land use planning and zoning ordinances have not kept pace with the rapid growth of e-commerce development—some municipalities have outdated plans and zoning ordinances; others lack plans and zoning altogether. Additionally, MPOs and RPOs felt that communities may not be considering previous comprehensive planning and zoning efforts in their decision-making related to e-commerce development.

Panelists noted an opportunity for greater private-sector participation in the land use planning and development process. Warehousing and distribution centers continue to proliferate statewide, and in many cases are expanding into areas that do not have adequate land use management tools to be able to measure and mitigate adverse impacts. The distinction between a traditional warehouse or distribution center and an e-commerce "fulfillment center" is important in land use and transportation planning. Key considerations related to this include zoning and site location (proximity to workforce and highways, compatibility with existing development, availability of water and sewer service and capacity); traffic and transportation impacts (assessing whether existing road infrastructure can accommodate increased truck traffic, to minimize congestion and improve the efficiency of goods movement); and environmental impacts (among the many concerns include air quality/emissions, noise, and stormwater runoff).

11. State government can provide general guidance and direction for local communities to plan for e-commerce facilities.

State government could support local communities with consistent guidance and tools for effectively planning for and accommodating e-commerce. A generally consistent approach statewide with flexibility for local priorities will be advantageous as compared to patchwork approaches that vary across thousands of municipalities. The intent of this recommendation is not to prevent growth of e-commerce facilities, but to guide and direct such investments to be community- and transportation-compatible.

Technology

12. Lack of reliable broadband Internet access limits participation in e-commerce by small businesses and potential consumers in many rural areas.

Efforts have been made in recent years to close the digital divide of Internet access in rural areas and in areas of economic distress. For small businesses, slow or inconsistent Internet connections make it difficult to establish and maintain an online presence, process digital transactions, and handle customer communications. On the consumer side, unreliable broadband access restricts access to e-commerce platforms, reducing opportunities to purchase goods and services conveniently online. TAC's separate study of trends impacting the transportation workforce included December 2024 stakeholder workshops in which the lack of broadband Internet was also noted as a barrier to workforce participation.

13. E-commerce is driving technological innovations.

Logistics firms aim to leverage technology in robotics to reduce some repetitive tasks and free up workers to handle higher-level tasks. Some maintain robotics in-house and work with their employees in robotics training and repair. Logistics firms also seek to use machine learning to reduce the carbon footprint of their goods by constantly adjusting product quantities and supply chains to meet anticipated customer demand. Some logistics firms are investing in EV technology in line-haul trucks. Technology can also help with smart signaling for traffic flow to maximize capacity of the existing transportation system. Drone technology is being tested for potential applications in open areas where interference from air traffic is not a concern, and where lightweight deliveries in sparsely populated areas can be accomplished without deploying delivery drivers to cover long distances between customers. While drone technology is sufficiently advanced to make deliveries in pilot tests, there are still questions about the economics and efficiency of these deliveries given the limitations related to payload size and weight.

14. It is unknown how autonomous vehicles, personal delivery devices, and other vehicle technologies will impact the transportation system in terms of goods movement as technology advances and e-commerce grows.

Prominent e-commerce companies have been working with transportation technology developers to test and refine innovative new technologies in freight transportation. These include low-emission and zero-emission delivery vehicles, automated vehicles, delivery drones, and sidewalk delivery robots. These efforts are still in their early stages, and are subject to challenging constraints such as payload weight limits (particularly for drones) and the customized nature of most e-commerce deliveries that does not lend well to the standardization of supply chain elements (package size, vehicle routing, vehicle operating characteristics, etc.) that is essential for successful adaptation of many technologies.

Data Needs

15. The distinctions between traditional retail commerce and e-commerce are difficult to identify and measure, yet important to differentiate.

While traditional retail commerce and e-commerce both involve the sale and delivery of similar products and services, the logistics patterns and distribution processes they employ in their business operations are markedly different. Electronic orders and payments, along with direct deliveries to customers, are among the defining characteristics of e-commerce. This has important implications for land use and demands on the transportation system.

Amazon has set the standard for e-commerce logistics and operations, but a growing number of traditional retail companies such as Walmart and Target are now engaged in a combination of brick-and-mortar retail sales and e-commerce. In many cases, these companies are handling their distribution operations for store deliveries and their e-commerce orders in the same warehouse facilities. For some merchandise, e-commerce orders are filled at retail locations by store employees and handled for local customer deliveries from a traditional store rather than a warehouse or dedicated e-commerce fulfillment center.

16. Quantifying the various impacts and benefits of e-commerce would be a useful future assessment to help decision-makers and transportation professionals.

Understanding the full end-to-end supply chains for e-commerce in comparison to traditional retail sales is critical for measuring impacts and benefits. While e-commerce is generally noted for its impact on transportation infrastructure and operations, it also eliminates myriad trips by individual consumers making purchases at retail stores. The Amazon representative on the expert panel suggested that there is a similarity between e-commerce package deliveries to multiple customers using a single delivery van and a public transit vehicle carrying multiple passengers in place of numerous single-occupancy vehicles. Other important environmental considerations include the changing waste stream for e-commerce, the desire for reduced packaging and delivery consolidation by e-commerce retailers, transitioning delivery vehicle fleets to EV technology (and electric grid capacity needs for this transition) and potential implementation of drone delivery.

Revenue

17. The package delivery fee proposed by the 2021 Pennsylvania Transportation Revenue Options Commission (TROC) is a potential revenue source, yet is not a comprehensive solution to the pressing transportation funding problem.

Package delivery fee revenue would grow as e-commerce grows, and the funds could be used for multiple transportation purposes (e.g., state and local) and the various transportation modes. States such as Colorado and Minnesota have implemented such fees. Maryland's Governor proposed a package delivery fee in January 2025 (as this study was nearing completion). The package delivery fee aligns with the funding principles of "user pays," growth, and flexibility of use:

- The “user pays” principle is aimed at aligning the fee with those who use the service and benefit from it. Users can be viewed as either the consumers who make purchases associated with e-commerce deliveries or the companies that make the deliveries. In Colorado, e-commerce is viewed as a convenience and the package delivery fee appears as a line item on the consumer’s purchase receipt.
- As a revenue source, a package delivery fee crafted appropriately would grow as e-commerce expands, allowing it to generally keep pace with inflation. This is an important distinction between the delivery fees adopted in other states and liquid fuel taxes that are established as a fixed value per gallon of fuel.
- Finally, if Pennsylvania were to implement a package delivery fee, it would allow flexible allocation of revenue as determined by policymakers across modes and between state and local governments.

A package delivery fee would not provide a total solution for closing Pennsylvania’s transportation needs–funding gap, but is arguably one of several potential solutions.

Recommendations

Transportation Planning, Infrastructure, and Services

A. Policymakers should consider a package delivery fee to fund needed transportation infrastructure improvements.

E-commerce has an impact on safety, traffic congestion, travel demand, roadway design, and bridge and highway maintenance, with a particular burden placed on the local transportation system. Addressing these issues across Pennsylvania's diverse regions requires investment in transportation planning and infrastructure. However, to the extent that e-commerce reduces personal shopping trips, there is an associated decline in fuel tax revenue to address these needs. Compensatory revenue strategies are necessary. A package delivery fee is a viable tool that can contribute to addressing the Commonwealth's transportation needs.

The local transportation funding need is vast. In 2021 the Transportation Revenue Options Commission (TROC) estimated the local funding gap at $3.9 billion a year and forecasted that it would grow to $5.1 billion by 2030, absent any new funding sources. Against that backdrop, e-commerce has grown quickly since 2021 and will likely do so through 2030 and beyond.

Pennsylvania's network of local roads is also vast. The Pennsylvania Highway Statistics 2023 Highway Data reports that there are 78,520 miles of local municipal-owned roads—roughly double the state-owned mileage. Of course, e-commerce is not expected to foot the bill for addressing the entire local infrastructure funding gap.

The net traffic change associated with e-commerce should be better estimated as reductions in consumer trips will to some extent offset the increase in e-commerce trip-making. As a growing source of overall traffic, e-commerce should be considered in determining how best to close the transportation funding gap for state and local transportation infrastructure. While more in-depth analysis is needed, the experience and perception of those traveling throughout the Commonwealth indicates steadily more e-commerce vehicles, including on the local network where "last-mile" travel occurs.

B. Work with MPO/RPO regions to develop regional freight plans that include intermodal strategies for goods movement and emerging e-commerce considerations at a local level.

PennDOT is subject to federal requirements to update its statewide freight plan every four years to remain eligible for federal freight funding. E-commerce considerations are among the required elements for state freight plans under the applicable federal statute. MPOs and RPOs should consider incorporating PennDOT's e-commerce data and other resources into their own regional freight plans. An important element of these planning efforts is to ensure that MPOs and RPOs consider the adequacy of roadway links between industrial clusters and the major highway system.

C. Address the public transportation needs for e-commerce workforce access.

With the greater need for on-site labor at e-commerce fulfillment centers than at traditional warehouses, public transit access is an important consideration—at a time when transit funding is facing its own challenges across the Commonwealth. This is especially true in areas where prime employee cohorts for e-commerce jobs have commuting challenges related to vehicle ownership, off-hour shifts, and proximity of job sites to residential and urbanized areas. Private industry and government representatives should consider route guarantees to supplement fixed-route public transit service with flexible, efficient services that are designed to meet the unique needs of these types of businesses. Some subsidization of additional routes or subscription services could be warranted based on the workforce benefits.

D. Develop a needs assessment for e-commerce related to transportation infrastructure (particularly for the local network).

The growth of e-commerce is impacting the transportation system nationally and in Pennsylvania. The specific impacts are less understood as of 2025. As such, a core analytical matter (beyond the scope of this foundation-building study) is: a) the need to develop estimates of the extent to which the increase in e-commerce transportation impacts infrastructure; and b) the associated costs for maintaining/improving the infrastructure.

Clearly there are more e-commerce delivery vehicles on the road with trips generated by consumers and fulfillment centers (including the sourcing of the products they deliver). It will be helpful to arrive at reliable estimates or rules of thumb to determine the net change in transportation system usage. The need to estimate net changes recognizes that some trip-making may be reduced as consumers are presumably taking fewer trips to make purchases. As such, TAC recommends that a defensible needs analysis be produced that:

- Estimates the net increased traffic generated through e-commerce and how that traffic volume distributes over state and local roads;
- Includes projected traffic growth associated with various e-commerce rates of growth; and

- Produces order-of-magnitude estimates of impacts that e-commerce travel has on the cost of maintaining and improving roads and bridges.

It is assumed that some of this recommended research will occur nationally and that PennDOT can draw on that work in addition to any specific Pennsylvania analyses.

Note that this recommendation is related to Recommendation N. The two could be carried out jointly.

Land Use and Local Government Support

E. Develop and promote the use of an e-commerce planning and development guidance handbook.

PennDOT and DCED should collaborate to develop smart guidelines for addressing e-commerce facilities in land use plans and updating zoning ordinances to accommodate e-commerce facilities. The guidance would be geared toward local governments and designed for flexibility, given the widely varying nature of Pennsylvania's municipalities. This guidance should include collaborative work with developers to identify the costs and benefits of e-commerce development, and methods to address transportation impacts to the greatest extent possible.

Stakeholders emphasized the importance of keeping the positive impacts of e-commerce in view, recognizing that e-commerce contributes to the local tax base and provides good-paying jobs, while also presenting transportation and land use challenges.

i. Develop an e-commerce model ordinance.

A model ordinance or model ordinance provisions should be prepared in tandem with the guidance handbook. A model ordinance could be developed to raise awareness among local officials and their communities, and to provide the basic information and tools to plan and manage land use appropriately. The language would include buffers, setbacks, zoning guidance, lot coverage, bulk dimensions, and on-site truck and delivery van parking and circulation requirements.

ii. Develop guidelines to incorporate urban delivery needs into "Complete Streets" standards and other roadway design elements.

E-commerce deliveries generally have a substantial impact in dense urban centers where interactions with other roadway users present a major challenge. "Complete Streets" policies aimed at accommodating a mix of vehicular traffic, transit vehicles, cyclists, and pedestrians often overlook the needs of delivery vehicles making frequent stops at locations where curb space is heavily regulated and often not available. On rural roads with adjoining residential and commercial land uses, wide shoulders should be considered as a design standard in locations where delivery vehicles cannot stop for deliveries without impeding the flow of traffic.

The interaction between delivery vehicles and cyclists presents a particularly important safety challenge due to issues such as vehicle size, sight distance, and the presence of marked bike lanes alongside curb parking lanes.

F. Municipalities should amend zoning regulations, including incorporating loading zones into any new developments.

On-site delivery needs should be incorporated into land development approvals. Accommodating off-street or on-street loading zones to facilitate e-commerce deliveries should be considered as a best practice for many types of land uses, mixed-use developments, office buildings and office parks, and downtown areas.

Public–Private Sector Collaboration

G. Pursue ongoing relationships with e-commerce providers, including engagement in appropriate forums.

Industrial real estate stakeholders, including facility owners, developers, and real estate brokers, can be instrumental members of active, effective freight advisory committees at the regional and state levels. Consider inviting a representative of a preeminent e-commerce company such Amazon to join organizations such as the TAC and MPO/RPO freight advisory committees.

H. Incorporate e-commerce as part of the statewide emphasis on truck parking accommodation and staging areas, including related public–private coordination.

PennDOT has been developing strategies to address the chronic shortage of truck parking and staging capacity across the Commonwealth. Its recent efforts reflect many of the recommendations of the 2023 TAC study on the subject. Ongoing and future development plans for new e-commerce facilities present a good opportunity for developers and municipal governments to incorporate truck parking and staging capacity into new industrial development projects. This is a site-specific best practice in industrial development and is most critical for new development sites along the Tier I and Tier II corridors identified in the 2023 TAC study.

I. Work with e-commerce retailers and industrial developers to identify opportunities for new e-commerce development in town centers to support existing and new business establishments.

E-commerce centers in urban areas, such as the Amazon hub in the heart of the University of Pennsylvania campus in Philadelphia, provide a glimpse into a future scenario in which e-commerce facilities are part of the community fabric. Joint ventures might be possible and even piloted, such as combinations of e-commerce hubs with convenience stores. Pennsylvania is home to several major convenience store chains; Pennsylvania-based chains such as Rutters, Sheetz, and Onvo have been active in developing new retail sites that may present ideal opportunities for e-commerce delivery hubs.

J. Explore locating e-commerce fulfillment centers on airport properties (which typically have available land, road access, and revenue challenges).

E-commerce relies less on aviation than other transportation modes, due to its need to locate fulfillment centers near customers and to use the most cost-effective modes for moving freight. Aviation, however, continues to carry out a key role in the shipment of high-value, lighter-weight, and time-sensitive goods and materials. Given the dynamic nature of e-commerce and its innovative business practices, there may be an opportunity to develop e-commerce fulfillment centers at Pennsylvania regional airports. Advantages of this strategy include:

- Airports typically have vast land holdings.
- Airports often struggle with finances and typically welcome new, compatible sources of revenue often transacted through lease agreements.
- Presumably, fulfillment centers on airports—both commercial service and larger general aviation facilities with highway access—could be in areas that do not conflict with air operations.
- Airports are generally located in areas where impacts on local communities have already been identified and addressed.

DCED and PennDOT's Bureau of Aviation should collaborate to identify potential locations for promoting and perhaps incentivizing or piloting such projects in partnership with the e-commerce industry, with input from the Pennsylvania Aviation Advisory Committee.

Data Collection and Analysis

K. Implement post-development traffic data collection programs for industrial sites to quantify the changing characteristics of site operations and deliveries as e-commerce continues to evolve.

Include detailed vehicle classifications to quantify distinctions among employee traffic, inbound and outbound heavy truck movements, and delivery vans. Develop more detailed and refined Pennsylvania regional profiles of various types of industrial land uses, consistent with trip generation rates published by the Institute of Transportation Engineers (ITE) for warehouses, high-cube transload and short-term storage warehouses, high-cube fulfillment centers, etc. This initiative might ideally be undertaken on a regional basis by MPOs and RPOs.

L. Analyze the impact of brick-and-mortar losses on various tax revenue streams in relation to e-commerce tax revenue gains.

As noted elsewhere, this TAC study underscores the need for more economic analysis in transportation decision-making. While TAC's statutory purview is transportation, it is weighing in with this recommendation, recognizing the indirect impact on transportation revenues.

M. Develop capabilities and tools for economic analysis for transportation planning.

Transportation organizations at all levels are increasingly called upon to demonstrate the economic rationale for and benefits of public investment in programs, projects, and other initiatives.

TAC's work on e-commerce has raised many questions, ideas, and perspectives about the economics of e-commerce. While PennDOT can contract for the services of transportation economists, the Department should consider the benefits of having a transportation economic analysis unit or individual on staff to carry out the function. The benefit of doing so could extend to providing technical assistance in this area to MPOs and RPOs.

N. Produce a quantitative analysis of the various impacts and benefits of e-commerce.

As a novel topic for transportation agencies, e-commerce presents some analytical challenges. The rapid changes and relatively new operating model of e-commerce retail sales and deliveries make it difficult to evaluate its relationship and impacts to the transportation network on a statewide basis. Similar challenges exist in evaluating land use changes driven by e-commerce at the local level.

The purpose of this study was to establish a foundation for understanding the impacts of e-commerce on transportation and land use. This was accomplished through the combined learning achieved through the expert panel, the survey of MPOs and RPOs and the literature review.

However, the projected continued high rate of growth of e-commerce necessitates more detailed data and analysis for several reasons:

- To develop analytical tools, rules of thumb, or basic models to help transportation planners and decision-makers (**analytical tools and models**).
- To produce a data set as to the extent of traffic volume that is comprised of e-commerce vehicles as compared to other traffic (**traffic analysis and congestion**).
- To help inform decision-making and decision-makers when e-commerce impacts public-sector transportation and land use/development (**policy-making**).
- To improve safety by being able to identify accidents or incidents in which e-commerce vehicles were involved (**safety**).
- To inform cost-sharing opportunities built on the foundation of a strong understanding of the public and private benefits and costs of e-commerce (**economics and funding**).

TAC recommends that such data collection and analyses be developed. Such research should leverage national forums, such as the Transportation Research Board (TRB).

As TAC values feedback and follow up on its studies, it is further recommended that a status report on the progress of such research (in Pennsylvania and nationally) be presented within 12 months of the adoption of this study. PennDOT should also consider opportunities for Pennsylvania's colleges and universities to contribute to building this body of knowledge.

Conclusion

When TAC was established in 1970, the General Assembly saw the need for an independent body to consider and advise upon key transportation matters and issues impacting transportation. At the time, no one could have imagined e-commerce and how ubiquitous it would be half a century hence.

While change is constant, TAC's mission is proving to be timeless. Transportation continues to evolve and the economy it serves changes even more rapidly, making TAC's advisory role particularly important. Conducting a study of e-commerce and its relationship to transportation and land use has been a novel initiative for the TAC. There is still much to learn about e-commerce and how our transportation system (state and local) can most responsibly accommodate its growth. This study established a foundation and initiated a dialogue among private and public stakeholders that can be an important springboard going forward.

TAC's expert panel session emphasized that e-commerce benefits the state's economy, consumers, and workers, and yields a growing source of state and local tax revenue. As such, TAC was asked to keep the benefits of e-commerce squarely in view while objectively considering its costs and other impacts.

As PennDOT and other key stakeholders consider TAC's recommendations and move toward implementation, the following approaches should be considered.

- **Sustaining partnership and collaboration** – Adapting to e-commerce is not the responsibility of any one organization. PennDOT should not go this alone, nor could it. An effective Pennsylvania response to e-commerce challenges and opportunities will span agencies, levels of government, and sectors.
- **Supporting smart transportation and land use planning** – The dynamic and unique pattern of e-commerce development underscores the need for local government to be proactive and to have updated tools and useful guidance. Perhaps one of the greatest opportunities is to establish the guidance and tools to help local governments—already strained in terms of resources and capabilities—appropriately accommodate e-commerce.
- **Building on the TAC dialogue** – This study brought together many varied e-commerce stakeholders. This study possibly had the greatest extent and diversity of stakeholder engagement of any TAC project to date. Building on that should prove to be valuable.

- **Organizing for progress** – A formal implementation group as has been formed following other studies may not be necessary, at least not immediately. The TAC does see an implementation framework developed by PennDOT in partnership with other key entities such as DCED and local government representatives as being beneficial.

  Overall, the focus for making progress should address, among other things:

  - Quantitative assessment of e-commerce economic benefits.
  - Quantitative assessment of e-commerce costs with respect to infrastructure impacts and congestion.
  - Providing guidance to local governments and their stakeholders as recommended by TAC.
  - Supporting any additional information needs of policy makers regarding their consideration of a package delivery fee.

Appendix A: Expert Panel Discussion Summary

August 7, 2024

e-Commerce Panel Discussion

SUMMARY

Pennsylvania Transportation Advisory Committee

Background and Introduction

Purpose

The Pennsylvania Transportation Advisory Committee (TAC) advises the State Transportation Commission (STC) and the Secretary of Transportation. It is dedicated to exploring transportation challenges in Pennsylvania and collaborating with a broad base of industry experts, policymakers, and agency staff to find opportunities and solutions that advance our transportation system to safely meet the needs of all Pennsylvanians.

"This was highly informative. If we could do more of these in the future, that would be great!"

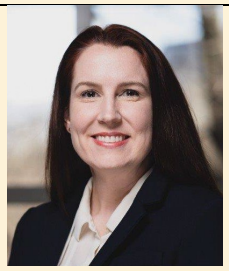
The TAC convened the expert panel session to gather firsthand input on e-commerce trends, issues, and opportunities to inform the TAC's study on e-commerce in the context of transportation and land use. The panel session was also intended to foster collaboration between the public and private sectors, and among the various levels of government, related to effective public policy addressing e-commerce.

Panelists

The event featured five panelists and a consultant moderator. The panelists were selected to cover perspectives and areas of expertise that are critical to understanding the topic of e-commerce and its implications for transportation infrastructure and land use. These perspectives include:

- The e-commerce industry
- Regional transportation and land use planning
- Local transportation impacts and land use implications (both urban and rural)
- Industrial development to support e-commerce industry needs

Panelist	Background
 **Chris Caba**, Senior Transportation Planner York County Planning Commission	Mr. Caba is a Senior Transportation Planner with the Transportation Planning Division of the York County Planning Commission. In this role he is responsible for conducting the planning and programming for multimodal transportation improvements in York County that are funded through federal or Commonwealth of Pennsylvania sources.

Panelist	Background
 **Sam Cressler**, Chair, Franklin County Metropolitan Planning Organization; Chair, Southampton Township, Franklin County	Mr. Cressler has served as a member of the PSATS Executive Board since 2020. His tenure as an elected official on the Southampton Township Board of Supervisors began in 1998, and he has served as the Board Chairman since 2020. He is also the Chairman of the Franklin County MPO, and has had a long, diverse career in grocery store management, trucking, and real estate development.
 **Kevin Hodge**, Brokerage Advisor, ROCK Commercial Real Estate, LLC	Mr. Hodge joined ROCK Commercial Real Estate in 2003. He specializes in industrial and land sales, and adaptive reuse projects. He has worked in commercial real estate, rehabilitation, and the economic development industry since 1996. During that time, Mr. Hodge has been involved in the development of more than 5.4 million square feet of new industrial buildings.
 **Maura Kennedy**, Senior Manager, Economic Development, Amazon	Ms. Kennedy brought a successful track record to Amazon from her experience in management and economic development for Philadelphia and Pittsburgh. A graduate of Cornell University and the Wharton MBA program, she specializes in community outreach, economic development, and government relations to help implement Amazon's major initiatives in Pennsylvania.
 **Richard Montanez**, Deputy Commissioner of Transportation, Philadelphia City Streets Department	Mr. Montanez has worked as an engineer with the City of Philadelphia for nearly three decades. As Deputy Transportation Commissioner, he is currently responsible for the maintenance, operation, and improvements of about 2,500 miles of local roads, 3,000 traffic signals, 280 bridges, and more than 100,000 street lights. An electrical engineer by trade, he began his career with the City in the Traffic Engineering and Street Lighting Divisions.

Moderator	Background
 **Tom Phelan, PE** Project Manager, Michael Baker International	Mr. Phelan has 30 years of experience in traffic and transportation consulting services in the U.S. and Canada. A licensed professional engineer in the State of New Jersey and the Canadian province of Alberta, he earned his Master of Science and Bachelor of Science in Civil Engineering at the New Jersey Institute of Technology. His areas of expertise include traffic engineering and design, transportation planning, freight planning and operations, and land use planning for freight terminals and industrial sites.

Format

The panel session was conducted online to facilitate cost-effective statewide participation.

The audience included a wide variety of interest groups, including TAC members, PennDOT staff, MPO/RPO representatives, municipal officials, and others. Approximately 250 people registered for the event, with 186 attending at the peak of participation. Participants were invited to post questions and comments online during the event; the moderator and support staff reviewed these and presented them to panelists as the discussion progressed.

TAC Chair Jody Holton provided brief opening remarks, followed by introductions of the moderator and each panelist. Panelists provided an overview of:

- How their organization or role relates to e-commerce.
- The top issues and opportunities from their perspective related to e-commerce, centered on the areas of transportation, land use, economic development, and/or public policy.

Panelists were asked to educate and inform—to educate in terms of what their perspectives are on e-commerce in relation to transportation and land use and to inform TAC on specific issues and opportunities that may shape the e-commerce study or future efforts.

Questions and interaction were invited from the virtual audience and from the panel. Panelists asked questions of one another as well.

The entire event lasted 90 minutes, with most of that time spent in open discussion among the panelists and moderator, with questions and comments presented to the panelists from online participants.

Major Themes

The TAC panel discussion centered around several themes, which are highlighted within this section.

1. **E-commerce is customer-driven** – E-commerce exists simply because business and personal customers want it. It is "the great equalizer," in that it extends the reach of retail sales into outlying exurban and rural areas that are far removed from concentrations of commercial establishments. The changes it has wrought in transportation and land use have been substantial, like those experienced a generation or two ago, when retail began moving away from established, downtown urban cores and into suburban environments. This shift is being reflected in the commercial landscape, as traditional brick-and-mortar retail establishments are being right-sized, encouraging e-commerce activity on their own, or closing down altogether. Former commercial buildings and properties across the state are now in need of repurposing as a result of these changes. Further study is needed to better determine the net results e-commerce is having on overall trip-making, with fewer customers traveling to brick-and-mortar retail stores in favor of commercial vehicles making deliveries to commercial establishments and residential neighborhoods. One panelist emphasized that local government is also customer-driven, indicating that a smart policy framework for e-commerce must both encourage the vast benefits for consumers while also addressing matters of public interest.

   "Logistics firms work backwards from the customer. That's the starting point. They want shorter customer delivery times and want to be as close as possible to where their customers are."

2. **E-commerce has a disproportionate impact on the local transportation system** – The local roadway network is now handling a sizable volume of commercial vehicle traffic that in many cases it was not designed to accommodate. By its nature, e-commerce drives a high volume of individual deliveries, leading to more commercial vehicles on local roadways. The last leg of delivery, commonly referred to as the "last mile," is typically the most costly part of shipping (because it is the most labor-intensive relative to the volume of merchandise that is being handled). E-commerce orders are often delivered as single items or small packages, which can require multiple delivery trips to multiple locations, sometimes within the same neighborhood, contributing to traffic congestion. The rise of same-day or next-day delivery puts increasing pressure on roadway networks. Conversely, consumers receiving e-commerce deliveries are likely making fewer shopping trips to traditional retail establishments.

   "Land use and traffic implications are a lot more complex and require careful future thinking and planning."

3. **E-commerce is driving a need for local land use planning to adapt** – Panelists noted that there is an opportunity for greater private sector participation in the land use planning and development process. Warehousing and distribution centers continue to proliferate statewide, and in many cases are expanding into areas that do not have adequate land use management tools to be able to measure and mitigate adverse impacts. The distinction between a traditional warehouse or distribution center and an e-commerce "fulfillment center" is important in land use and transportation planning. Key considerations related to this include zoning and site location (to minimize congestion, sprawl, and improve the efficiency of goods movement); traffic and transportation impacts (assessing whether existing road infrastructure can accommodate increased truck traffic); and environmental impacts (among the many concerns include air quality, emissions, and stormwater runoff).

> *"We should not have a 'build first, plan later' approach. These warehouses are going to be here a long time. We should more adequately fund planning departments locally and statewide, and embed planners within PennDOT."*

4. **The distinctions between traditional retail commerce and e-commerce can be difficult to identify and measure** – A company like Amazon has set the standard for e-commerce logistics and operations. But a growing number of traditional retail companies such as Walmart and Target are now engaged in a combination of brick-and-mortar retail sales and e-commerce. In many cases, these companies are handling their distribution operations for store deliveries and their e-commerce orders in the same warehouse facilities. For some merchandise, e-commerce orders are even filled at their retail locations by store employees and handled for local customer deliveries from a traditional store rather than a warehouse or dedicated e-commerce fulfillment center.

5. **E-commerce is driving innovations in technology** – Logistics firms are hoping to leverage technology in robotics to reduce some repetitive tasks and free up workers to move up to higher-level positions. Some maintain robotics in-house and work with their employees in robotics training and repair. Logistics firms seek to use machine learning to reduce the carbon footprint of their goods and some are investing in EV technology in line-haul trucks. Technology can also help with smart signaling for traffic flow to maximize capacity of the existing transportation system. Drone technology is being tested for potential applications in open areas where interference from air traffic is not a concern, and where lightweight deliveries in sparsely populated areas can be accomplished without deploying delivery drivers to cover long distances between customers.

6. **E-commerce facilities require improved workforce access** – E-commerce fulfillment centers typically require more employees than conventional warehouses, due to the handling required for individual orders. The jobs typically pay a good wage, providing opportunities for many Pennsylvanians. There may be the need to consider the various aspects of workforce access including public transportation, shift work, and proximity to residential and urbanized areas. Geographically, in many instances these facilities are located in areas away from available fixed-route public transportation service.

"In many instances, the housing for workers at e-commerce facilities is not adjacent to where they work. Typically when employees head in for their 12-hour shift they are traveling 45 minutes or more to their worksite and back. This extended workday has huge impacts on the rearing of their children and quality of life. What should be done to push for more housing convenient to these facilities, which are typically located in rural, low-density areas?"

7. **E-commerce may have yet-to-be-determined implications for transportation system operations** – We continue to see the merging of information technology with transportation operations. Potentially there are ways in which the e-commerce sector can interface with the public sector to better manage the transportation system throughput via collaboration. The overall goal of maximizing throughput for the e-commerce industry should naturally complement the need for maximizing the efficiency of the transportation system for all users.

8. **E-commerce has important implications for street operations and design, particularly in dense urban centers** – The combination of high service frequency and smaller delivery size (relative to traditional truck deliveries) makes for a challenging street landscape in which delivery vehicles must now be considered as another road user along with passenger vehicles, large trucks, public transit, pedestrians, and cyclists. In addition to the added traffic volume, there are important implications for curb access and sidewalk space for handling deliveries.

9. **E-commerce offers employment and other economic benefits** – E-commerce is labor-intensive, and typically combines the attractive characteristics of competitive hourly wages and flexible work schedules for 24-hour operations. E-commerce facilities also provide property tax revenue for local governments. A key takeaway is that policymakers will need to consider both the benefits and costs associated with e-commerce in formulating sensible approaches. There is a need to sort out public/private benefits and costs: balancing costs of offsite improvement needs and the benefits of tax revenue that are generally shared between municipal governments and local school districts.

10. **Quantifying the net environmental impacts and benefits of e-commerce deliveries are an important next step in this process** – Understanding the full end-to-end supply chains for e-commerce in comparison to traditional retail sales is critical for measuring impacts and benefits. While e-commerce is generally noted for its impact on transportation infrastructure and operations, it also eliminates myriad trips by individual consumers making purchases at retail stores. There is a similarity between e-commerce package deliveries to multiple customers using a single delivery van and a public transit vehicle carrying multiple passengers in place of numerous single-occupancy vehicles. Other important environmental considerations include the changing waste stream for e-commerce, the desire for reduced packaging and delivery consolidation by e-commerce retailers, transitioning delivery vehicle fleets to EV technology, and electric grid capacity needs for this transition.

> *"How can we appropriately charge trucks for the wear and tear they create on our roads?"*

Closing

The study task force and the TAC will consider the wide range of stakeholder input obtained through the panel session. It is expected to have a bearing on the study's ultimate findings and recommendations. It will also inform its further near-term analysis prior to report drafting, particularly in terms of the case studies that will be undertaken to measure the impacts and benefits of e-commerce vs. traditional warehousing and retail sales. The study will be available on the TAC website after it is reviewed and accepted by the full TAC and the State Transportation Commission.

Appendix B: Colorado Department of Revenue Retail Delivery Fee Presentation

Retail Delivery Fee

Amber Egbert & Laura Braunstein
Colorado Department of Revenue
2024 FTA Revenue Estimating Conference

COLORADO
Department of Revenue

History

- **Enacting bill:** SB21-260 Sustainability of the Transportation System, signed into law June 17, 2021
  - https://leg.colorado.gov/bills/sb21-260
- **Modifying bill:** SB23-143 Retail Delivery Fees
  - Added exemptions & allowed retailers to elect to pay fee for purchasers
  - https://leg.colorado.gov/bills/sb23-143
- **Fee purpose:** to help pay for transportation infrastructure
- **Start date:** July 1, 2022; Modifications were retroactive

Definition

- **What?** Retail Delivery Fee on deliveries by motor vehicle to a location in Colorado with at least one item of tangible personal property subject to state Sales or Use Tax
- **Who?** Collected by or paid by the retailer or marketplace facilitator that collects the Sales or Use Tax
- **Details:** When taxable goods are mailed, shipped, or delivered by motor vehicle to a purchaser in Colorado
- **Citation:** §43-4-218, Colorado Revised Statutes (C.R.S.)

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https://tax.colorado.gov/retail-delivery-fee

Why that Definition?

- Makes administration and compliance easier by reducing novel definitions and reporting requirements
- Draws from an existing filing population - retailers with state sales tax accounts who make retail deliveries
- Tied retail deliveries to transactions subject to sales tax

Stakeholdering & Policy Development

- Policy development included:
  - Legislative leaders
  - Governor’s office
  - Other state agencies & enterprises (revenue recipients)
  - Delivery-heavy business community (UberEats, Amazon, restaurants, etc)
- HEAVILY informed policy structure

Qualified Business Exemptions

Two kinds of exemptions:

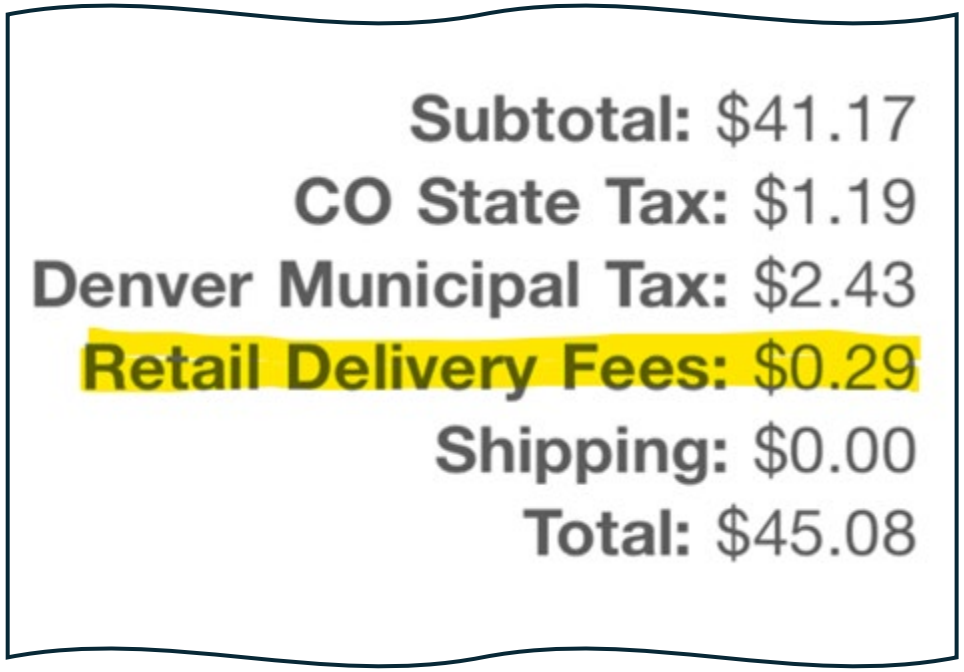
1. Retail sales in Colorado in the previous year <$500K
2. No physical location in Colorado & retail sales in Colorado < $100K

Why a Fee? TABOR and Enterprises

- Colorado has a Taxpayer Bill of Rights (TABOR) in constitution
- Limits by formula the state's ability to increase taxes or to increase expenditures with some exceptions
- Fees to enterprises are an alternative approach for critical funding needs
- Your state could choose to implement as a tax or a fee

Display of Fee

- Must be displayed separately
- Label: “Retail Delivery Fees”



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Retailer Can Pay the Fee

- Any retailer can choose to pay the fee for their customers
- Have to do this for all customers
- Fee would not be displayed on receipt/invoice

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https://tax.colorado.gov/retail-delivery-fee-collection-and-retailer-election

Retail Delivery Fee Rate

- Current fee: $0.29
- Fee is updated each state fiscal year (July 1)
- Prior fees:
  - FY 22-23: $0.27
  - FY 23-24: $0.28

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https://tax.colorado.gov/retail-delivery-fee-rates

Retail Delivery Fee Composition

The Retail Delivery Fee is made up of six different fees paid to six different enterprises:

- Community Access Retail Delivery Fee
- Clean Fleet Retail Delivery Fee
- Clean Transit Retail Delivery Fee
- General Retail Delivery Fee
- Bridge and Tunnel Retail Delivery Fee
- Air Pollution Mitigation Retail Delivery Fee

Retail Delivery Fee Rates

Fee Type	July 2022 To June 2023	July 2023 To June 2024	July 2024 To June 2025
Community Access Retail Delivery Fee	$0.0690	$0.0716	$0.0741
Clean Fleet Retail Delivery Fee	$0.0530	$0.0550	$0.0569
Clean Transit Retail Delivery Fee	$0.0300	$0.0311	$0.0322
General Retail Delivery Fee	$0.0840	$0.0870	$0.0903
Bridge and Tunnel Retail Delivery Fee	$0.0270	$0.0280	$0.029
Air Pollution Mitigation Retail Delivery Fee	$0.0070	$0.0073	$0.0075
Total Retail Delivery Fee	$0.27	$0.28	$0.29

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Rate Adjustments

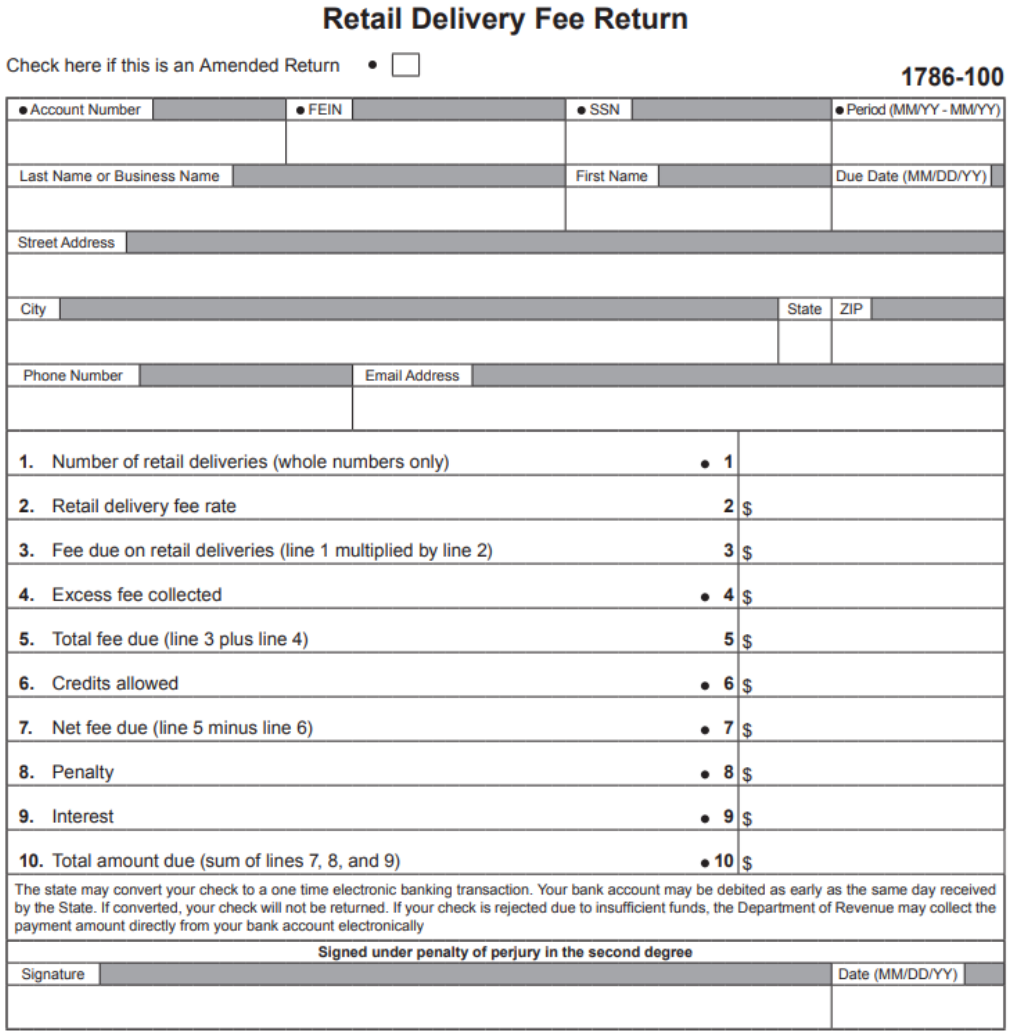
- Adjusted for inflation annually by July 1st
- Uses the Bureau of Labor Statistics consumer price index - all items, all urban consumers for Denver-Aurora-Lakewood, CO
- Inflation adjustment:
  - Must be positive
  - Is cumulative from the time of last adjustment
  - Is rounded to nearest whole cent
  - Must increase by at least one whole cent
  - Is limited to 5%

Retail Delivery Fee Return

Same due dates as sales tax returns (typically monthly)

Information Collected:

- Number of retail deliveries
- Rate
- Fee due on retail deliveries
- Excess fee collected
- Credits allowed
- Penalty
- Interest
- Total due



Retail Delivery Fee Return

Check here if this is an Amended Return • ☐ **1786-100**

• Account Number	• FEIN	• SSN	• Period (MM/YY - MM/YY)

Last Name or Business Name	First Name	Due Date (MM/DD/YY)

Street Address		

City	State	ZIP

Phone Number	Email Address

1. Number of retail deliveries (whole numbers only)	• 1	
2. Retail delivery fee rate	2	$
3. Fee due on retail deliveries (line 1 multiplied by line 2)	3	$
4. Excess fee collected	• 4	$
5. Total fee due (line 3 plus line 4)	5	$
6. Credits allowed	• 6	$
7. Net fee due (line 5 minus line 6)	• 7	$
8. Penalty	• 8	$
9. Interest	• 9	$
10. Total amount due (sum of lines 7, 8, and 9)	• 10	$

The state may convert your check to a one time electronic banking transaction. Your bank account may be debited as early as the same day received by the State. If converted, your check will not be returned. If your check is rejected due to insufficient funds, the Department of Revenue may collect the payment amount directly from your bank account electronically

Signed under penalty of perjury in the second degree

Signature	Date (MM/DD/YY)

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https://tax.colorado.gov/sites/tax/files/documents/DR_1786_2024.pdf

Retail Delivery Fee Revenue

Reported monthly on Transportation Fees Revenue Report website:

https://cdor.colorado.gov/data-and-reports/state-revenue-data/transportation-fees-revenue-report

$7.8M average monthly revenue

Compare to:

- $4.6M for liquor excise tax
- $16.7M for gaming tax
- $360M for sales tax

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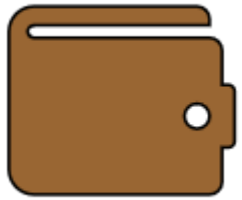
Monthly Fee Revenue & Population

$7.8M fee revenue

4.7M people (18+)

$1.66/ person



~6 retail delivery fee transactions

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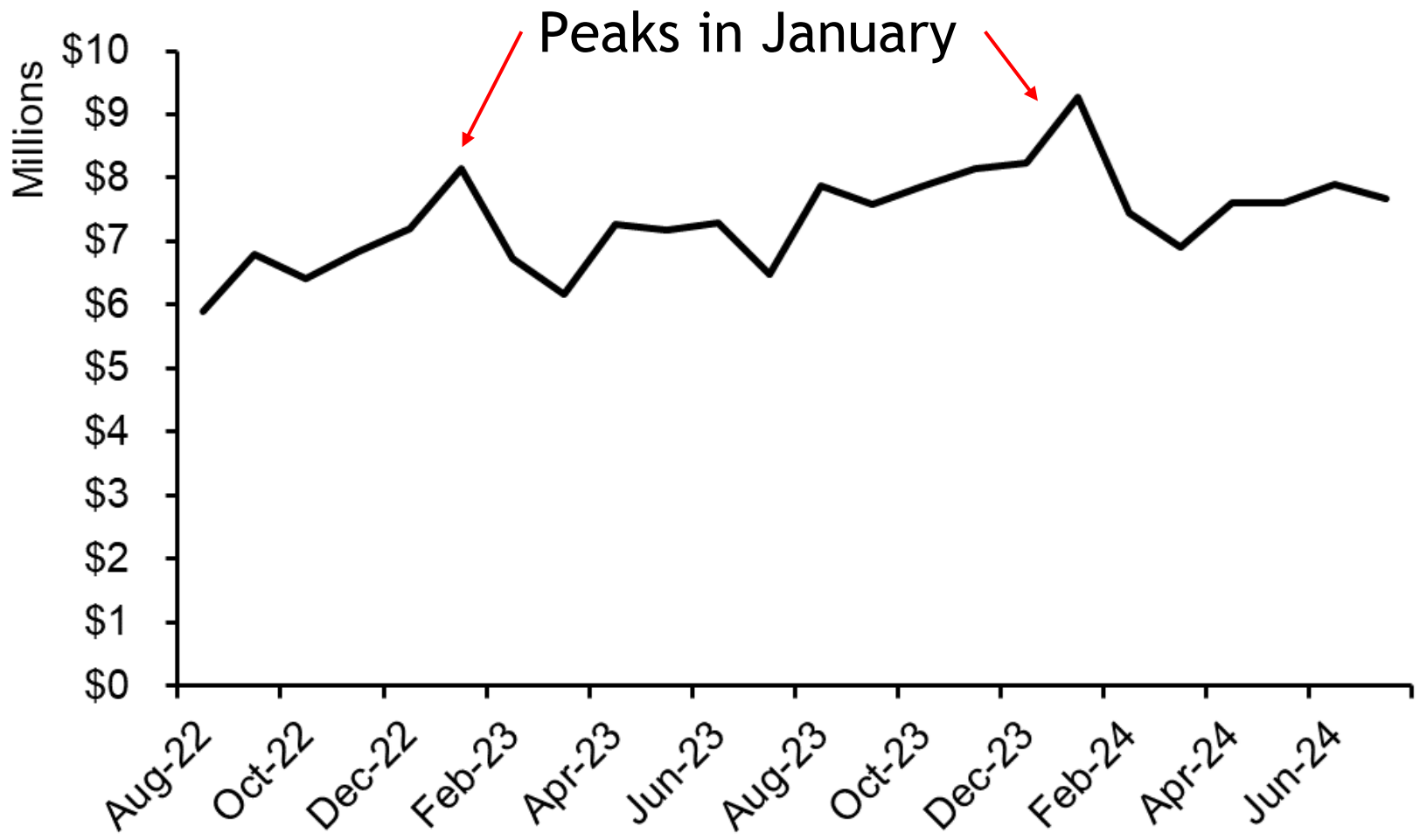
Delivery Fee Revenue Since August 2022



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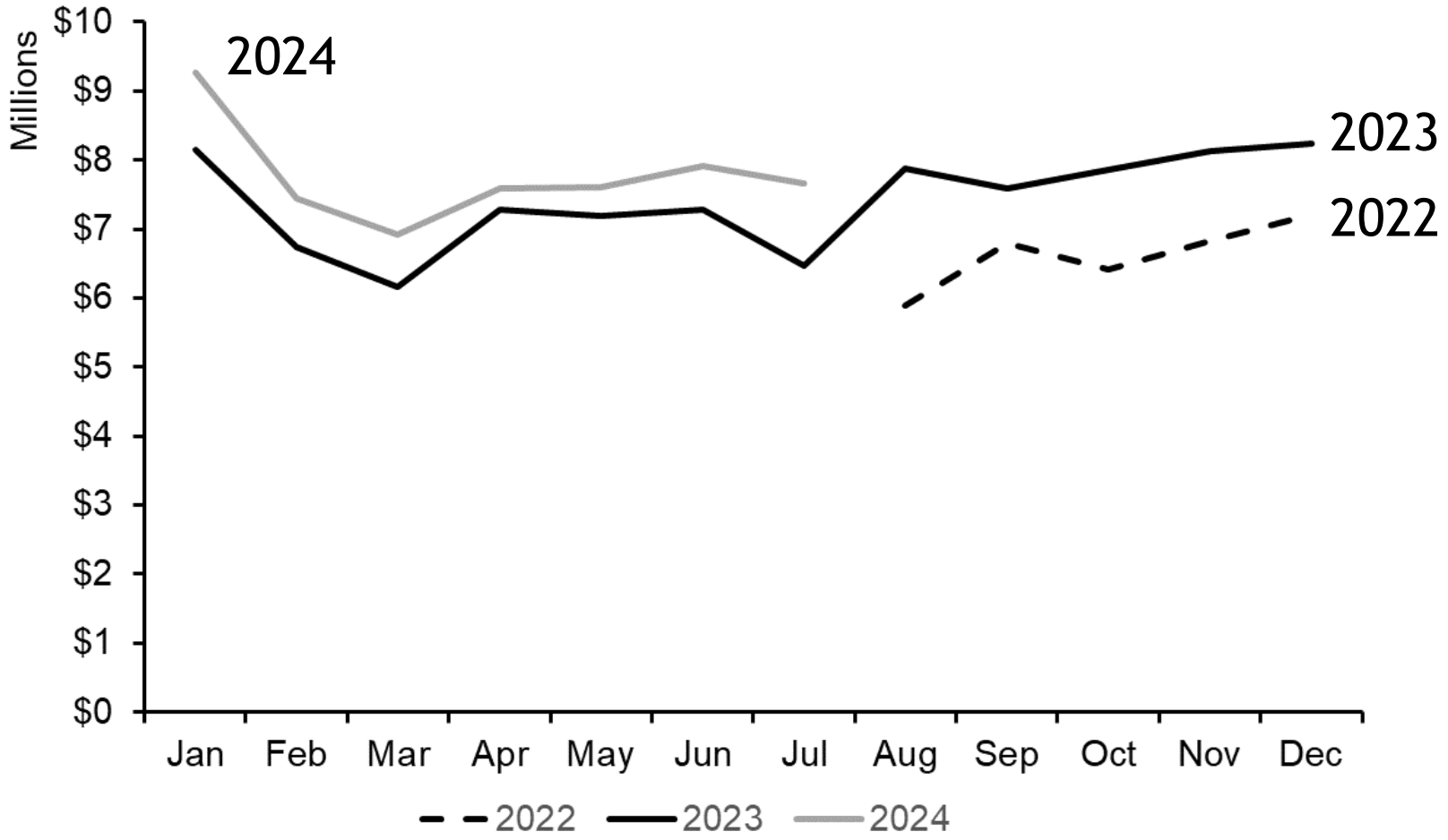
Delivery Fee Revenue by Year

11% avg YOY increase 2023 to 2024, before inflation adjustment

7.5% avg YOY increase after



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Other Transportation Funding Tools in CO

- Per Ride Fee (~$770k/month, collected quarterly)
  - Different rates for individual vs pools/sharing and traditional fuel vs EV rides
- Indexing of Vehicle Daily Rental Fee to inflation
- Added Road Usage fees to the gas and diesel fuel taxes indexed to inflation
- EV annual registration fee
  - Started at $50/year, indexed for inflation currently $57.19/year

Summary

- Fee definition is important for administration & compliance
- Deliveries by motor vehicle
- Consider inflation adjustments
- Revenue will vary with population

Questions? & Contact Info

Amber Egbert
Director, Research and Legislative Services
Taxation Division, Colorado Department of Revenue
amber.egbert@state.co.us

Laura Braunstein
Managing Data Scientist, Office of Research and Analysis
Taxation Division, Colorado Department of Revenue
laura.braunstein@state.co.us

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