Parallel SYSTEMS

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BEFORE THE

UNITED STATES SURFACE TRANSPORTATION BOARD

Ex Parte 775

GROWTH IN THE FREIGHT RAIL INDUSTRY

TESTIMONY OF

PARALLEL SYSTEMS, INC.

TO BE DELIVERED VERBALLY WITH EXHIBITS

BY

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HEAD OF STRATEGY

SEPTEMBER 17, 2024

OUTLINE OF PARALLEL SYSTEMS' TESTIMONY, DELIVERED BY MARTY SCHLENKER

I. Greeting and introduction
II. The supply chain is evolving
III. Supply chain evolution does not favor prevailing rail service offerings
IV. New technology enables a new rail service offering
V. The new service offering responds to shipper preferences and site choices
VI. The new technology also provides safety, environmental, and community benefits
VII. Public objectives can be met by rail if innovation is supported

I. Greeting and introduction

Good day Chairman Primus, distinguished Board members, and fellow supply chain professionals.

My name is Marty Schlenker. I have served as Head of Strategy for Parallel Systems since September 2023. Before joining Parallel, I was employed by Class I railroads BNSF and CSX for 25 years, serving in leadership positions in rail operations management, service planning, finance, and technology, including serving as BNSF's Assistant Vice President, Merchandise Service Design from 2012 to 2019. I am a member of the American Railway Engineering & Maintenance Association and serve on its Economics, Information Technology, and Positive Train Control technical committees. I have also served as a consultant to shippers, ports, railroads, and industry suppliers. My career in railroading was launched with a Master's degree at the MIT Center for Transportation Studies with a fellowship provided by the Association of American Railroads.

Parallel Systems is a developer of independent battery-electric rail vehicles, founded in 2020 in Los Angeles, CA. Parallel is a 2021 US Department of Energy ARPA-E awardee under the Transformational Projects in Energy open grant program. Genesee & Wyoming, in collaboration with Parallel, petitioned the Federal Railroad Administration in August 2023 to test Parallel vehicles on two of its shortlines[1].

Parallel chose to testify to provide an exposition of supply chain evolution, its implications for rail, and why innovative new technology is crucial to railroad growth. In

[1] Docket for the testing petition: https://www.regulations.gov/docket/FRA-2023-0066

addition to railroad growth, new technology provides multiple public benefits. It must be embraced and accelerated.

II. The supply chain is evolving

Parallel acknowledges the rail carloadings data cited by the Board in the hearing notice[2]. The US Bureau of Economic Analysis' Gross Output by Industry data shown in Exhibit 1 further indicates that trucks continue to gain share of both revenue and volume as the supply chain evolves[3].

Multiple simultaneous forces drive supply chain evolution in the US, including technological and business innovation, foreign trade, consumer confidence and preferences, government spending and policy, the country's geographic distribution of population and wealth, and businesses' choices in siting and designing facilities that generate and handle freight.

Among those, Parallel will focus its testimony on the last one, and specifically on the effects of the growth of e-commerce, which has become a critical influence on all distribution. E-commerce is a driver of trucking's recent share gain, and a determinant of rail's future prospects. As shown in Exhibit 2, E-commerce made up just 0.8% of retail sales in 2000. It now exceeds 15% of retail sales[4].

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[2] Source: Association of American Railroads and Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/RAILFRTCARLOADSD11#0

[3] Graph derived from https://apps.bea.gov/industry/Release/XLS/GDPxInd/GrossOutput.xlsx

[4] Source: US Census Bureau and Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/ECOMPCTSA

E-commerce uniquely emphasizes speed, and is essential in business-to-business sales as well as online shopping by consumers. Fast fulfillment requires regional maintenance of inventory. Not every SKU need be present in every fulfillment center as long as positioning moves can be made between centers in one day, and delivery the next.

Significantly, e-commerce removes a link in the distribution chain. The fulfillment center is the new retail store. For one such center to satisfy the demand of a large metro area, it needs to be very large under one roof.

Evidence of the power of these forces can be seen in Exhibit 3, the St. Louis Fed's tracking of the retail inventory-to-sales ratio. It has dropped gradually, then suddenly, to lowest-ever levels[5].

To facilitate fast fulfillment, a tremendous wave of warehouse, distribution center, and fulfillment center construction has occurred. BEA Gross Output data shown in Exhibit 4 demonstrates that warehousing, not trucking, is the true supply chain juggernaut[6].

One might consider it a paradox that inventory handling space is at highest-ever levels while inventory turns faster than ever. It is not a paradox. The fast turns are a planned consequence of massive, tailored investment in goods-handling facilities.

Leading commercial real estate firm CBRE publishes an Industrial Big Box Review & Outlook annually. Exhibit 5 illustrates that from 2019 to 2023, total industrial big box square footage grew by one third, with more than 400 million square feet entering service

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[5] Source: US Census Bureau and Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/RETAILIRSA

[6] Graph derived from https://apps.bea.gov/industry/Release/XLS/GDPxInd/GrossOutput.xlsx

in 2023 alone. More than 20% of all such properties tracked by CBRE are less than five years old[7]. The logistics infrastructure of the future is arriving today.

III. Supply chain evolution does not favor prevailing rail service offerings

The modern logistics facility is truck-centric in its design, and not sited for direct rail service. A typical example is shown in Exhibit 6[8]. Increasingly, municipalities and developers have worked together to create logistics campuses, convenient to highways and surface streets. Provision for direct rail access is spotty at best. Exhibit 7 presents a montage of such campuses around the country[9], a small fraction of the evolved industrial real estate picture.

Even when located near an intermodal terminal, as are several of the example campuses, rail service lanes are limited. In our experience, the average rail intermodal service offering reaches fewer than a dozen destinations from a given origin, and service in lanes under 500 miles is the exception rather than the rule.

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[7] Graphs derived from CBRE North American Industrial Big Box Review and Outlook:
https://www.cbre.com/insights/reports/2024-north-america-industrial-big-box
https://www.cbre.com/insights/reports/2023-north-america-industrial-big-box
https://www.cbre.com/insights/reports/2022-north-america-industrial-big-box
https://mediaassets.cbre.com/-/media/project/cbre/shared-site/insights/local-responses/2020-industrial-big-box.pdf?rev=1e71b73a903f477daf0607410ca70b67

[8] 1895 Duffy Road, Fernley, NV. 750,000 sq ft. https://maps.app.goo.gl/tRpG7ZhKd6m5EbzK8

[9] Aerial photographs sourced from Google Earth and the Surface Transportation Board National Rail Network Map.
https://stb.maps.arcgis.com/apps/mapviewer/index.html?webmap=96ec03e4fc8546bd8a864e39a2c3fc41.
Locations as captioned.

These facts make it difficult for railroads to provide anything more than token service to modern logistics campuses. As logistics campuses grow, trucking grows. Rail struggles, despite manifest efforts.

The concern deepens as one observes that industrial developers have discovered a winning formula. Big boxes are inexpensive to design and construct, and municipalities wishing to attract stable jobs willingly facilitate water, power, and road access.

Like people, businesses migrate to opportunity. Large, modern, flexible sites convey competitive advantage. It is easy to envision that manufacturing would follow logistics into these campuses, abandoning existing rail-served sites judged undersized, anachronistic, or poorly served. For rail, this amounts to "playing hard to get", but with high stakes.

Any person or body concerned about the future prospects of rail must acknowledge that businesses handling palletized freight are voting against rail with their site choices.

Parallel does not believe this trend can be reversed or even arrested. This infrastructure is in the ground, and more of it will be in the ground next week and next month. Rail must respond, and must respond with a new approach.

IV. New technology enables a new rail service offering

Any freight carrier seeking to serve modern logistics campuses must provide vehicles on demand, each vehicle independent of others; move shipments denominated in truckloads; move them promptly; and move them anywhere.

Parallel Systems was founded to provide this set of capabilities to railroads. In contrast to conventional railcars, Parallel is designing its vehicles to be independent. Each will have its own drivetrain, brakes, navigation, and perception capabilities. Instead of waiting for pickup, movement to a serving yard, sorting, and assembly into trains, Parallel vehicles are designed to depart upon release, route directly to destination, and dynamically form platoons with each other or behind conventional trains.

Exhibit 8 illustrates a Parallel prototype vehicle, embodying multiple innovative departures from existing rail technology:

- A battery-electric drive system enables movement
- Regenerative and hydraulic brakes enable speed control, energy recapture, and stopping
- Bumpers enable platooning and force transfer between vehicles
- Onboard and cloud-based software provides motion control and navigation
- Multiple sensing systems and their supporting data transmission and processing capabilities enable manual, remote, and automated operation
- The prototype vehicle platform is configured to accept a 40' ISO container, and will be followed by 53' container and trailer configurations. Containers and trailers may be lifted on or off, or loaded and unloaded while mounted on the vehicles

Independence enables on-demand deployment, one vehicle for one shipment. Parallel's vehicles and software are being designed to integrate with existing train control

technology. Platoons of Parallel vehicles will self-form to minimize network footprint and grade crossing occupancy, and will utilize latent network capacity between existing trains.

Parallel vehicles will require charging, but with significantly lower power requirements than battery-electric Class 8 tractors or locomotives. Adapting existing Level 3 chargers to Parallel vehicles requires little re-engineering. Distributing charging infrastructure to customer sites in addition to ports and intermodal terminals will minimize the burden on the grid, as will the low energy use inherent to the low rolling resistance of steel wheels on steel rail.

Taken together, Parallel's innovations enable railroads to tailor service to individual shipments, avoiding the aggregation, sorting, and large-batch movement that pose a barrier to today's increasingly prevalent short haul, single-load, time-sensitive freight.

V. **The new service offering responds to shipper preferences and site choices**

For any service offering to take hold in the market, it must serve the interests of freight shippers. Studies of shipper preference between rail and truck, including recent prominent work by our colleagues at Oliver Wyman, document shippers' preference for truck over rail, explaining the migration to non-rail-served sites. In its 2020 RailTrends presentation[10], Oliver Wyman summarized shipper sentiment, and made these prescriptions for rail:

- Serve the New Supply Chain

[10] https://www.oliverwyman.com/content/dam/oliver-wyman/v2/media/2020/nov/Rail_Trends_2020.pdf

- Improve the Transit Experience
- Embrace Customer-centricity

Paraphrasing these prescriptions in the voice of the shipper, “I’m over here now. Come to me. Ship everywhere I need you to go. Move when I need you. Don’t force me into your plan. Help me execute my plan.”

Independent, battery-electric rail vehicles such as Parallel is developing hold this potential for rail. While not always able to match highway speeds, our vehicles’ ability to depart upon release and proceed directly to destination represents a significant step forward in railroads’ ability to provide responsive, high-velocity service.

Independent vehicles won’t instantly enable access to every logistics campus shown in Exhibit 8. In the short run, our vehicles will connect essentially any pair of rail-served factories, warehouses, transload sites, intermodal terminals, or ports with direct service in lots as small as a single container.

Independent vehicles do not require full-train-sized intermodal terminals. In the long run, Parallel expects that railroads, logistics campus developers, or other third parties will develop micro-terminals which will enable containers and trailers to move on rail to within 1 to 5 miles of a campus’s big boxes, and be retrieved by customers’ existing day cabs and personnel. Campuses still on the drawing board may have micro-terminal space allocated from the start, and heavy corridors designated within.

Parallel has studied truck economics for both local drayage and over-the-road service, and understands where the bar is set. At scale, our vehicles will enable railroads

to offer this service in a way that is economically competitive with trucks, not just in niche applications but broadly within the market.

VI. The new technology also provides safety, environmental, and community benefits

Every truck shipment converted to movement on a Parallel vehicle carries the potential to improve transportation safety. The Texas A&M Transportation Institute, in a 2022 study for the National Waterways Foundation, found that transportation fatalities per ton-mile of freight were 3.6 times higher with truck than with rail, and injuries per ton-mile of freight were 10.9 times higher with truck than with rail[11].

Parallel vehicles are being designed to reduce or eliminate risk exposures for railroad workers.

Substitution of bumpers for couplers and Parallel's braking technologies for air brakes eliminate the need for operators to position themselves within the plane of the track while marshalling Parallel vehicles. All operator actions may be taken from a safe position clear of the track.

Parallel vehicles are not designed to be ridden by operators. If a forward view is necessary and an operator is not positioned to have this view, the vehicles' forward-facing cameras provide the view to the operator.

[11] https://www.nationalwaterwaysfoundation.org/study/FinalReportTTI.pdf. Figures ES-6 and ES-7.

Parallel intends to engineer production vehicles hauling containers with automated twistlocks, to further reduce an exposure of intermodal terminal workers.

Every truck shipment converted to movement on a Parallel vehicle is estimated to reduce carbon emissions by 72% vs. diesel trucks and 45% vs. battery-electric trucks. Battery-electric trucks may reduce emissions compared to diesel trucks, but they are no match for steel wheel on steel rail.

Finally, conversion of shipments from truck to Parallel vehicles removes trucks from both highways and surface streets, especially in the short-distance, truck-dominated corridors in which rail holds little share today. Parallel has not yet estimated the time savings for motorists as trucks are removed from shared corridors, or the public savings from road wear reductions, that are specific to its early use cases, but Parallel is confident that at scale, implementation of Parallel vehicles will be felt positively by communities.

VII. Public objectives can be met by rail if innovation is supported

Industrial big boxes, clustered in campuses, are the present and future of distribution in the Unted States. Their emergence is the result of businesses' free choice and innovation, supported by governmental bodies and policies.

For railroads to grow, as every participant in this hearing desires, railroads must respond positively to supply chain evolution by augmenting their existing service offering with independent, battery-electric rail vehicles such as Parallel is developing. Their public and private benefits are within reach without massive infrastructure investment. They are

within reach without wholesale change in economic regulation of rail or nationalization of the rail network.

Innovative technology of this nature cannot reach the market without support. Parallel benefits from collaboration with developmental partner railroads in the US and overseas, but this is not enough.

Parallel Systems advocates for these specifics to accelerate the development of independent, battery-electric rail vehicles, enabling railroad growth:

1. Rapid and transparent handling of petitions to allow testing, and then to establish this technology in regular operation in the United States
2. Local, state, and federal support for testing on the US rail network
3. Formal inclusion of independent, battery-electric rail vehicles, chargers, system integration, and other supporting investments in all public incentive programs for transportation decarbonization
4. Continued support for programs such as ARPA-E's SCALEUP which defray the cost of manufacturing setup for new environmentally-beneficial technologies
5. Sunset of transfers from the United States General Fund to the Highway Trust Fund, or establishment of a similar Railway Trust Fund, to align public spending with public priorities to improve transportation safety, environmental impact, and system performance

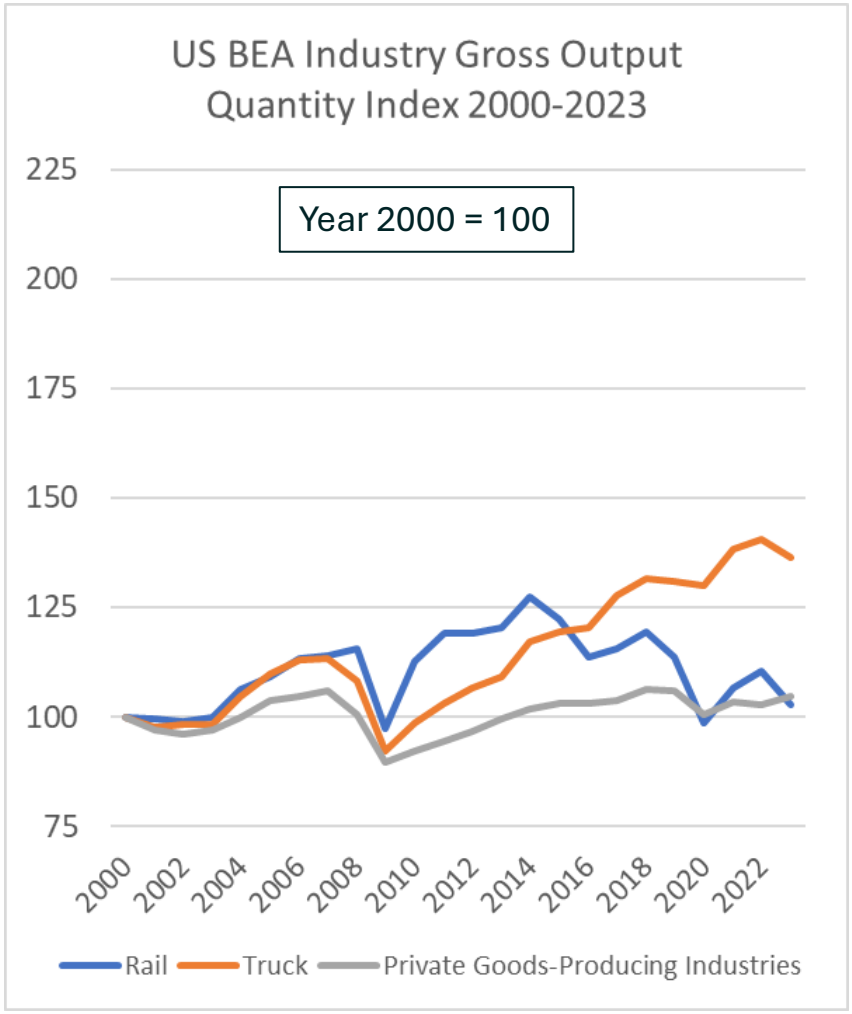
In closing, all of us at Parallel Systems wish to thank the Board for providing this forum and the opportunity to share our perspective.

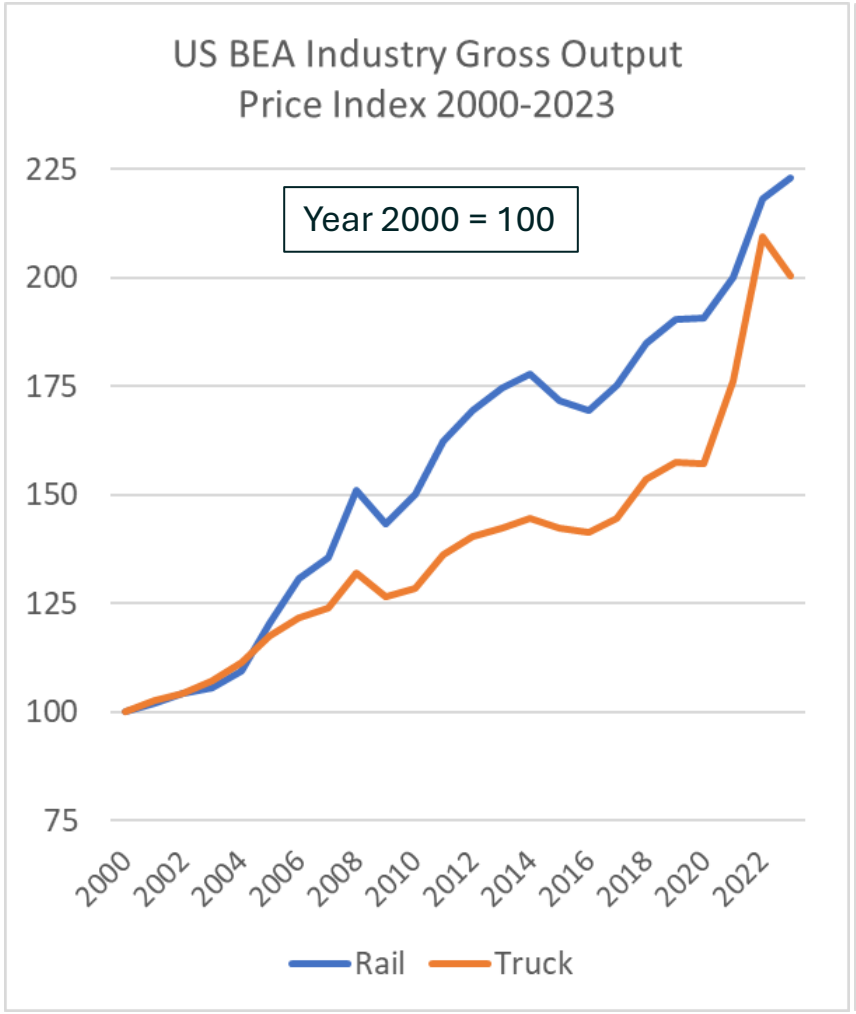
Exhibits to EP 775 Testimony

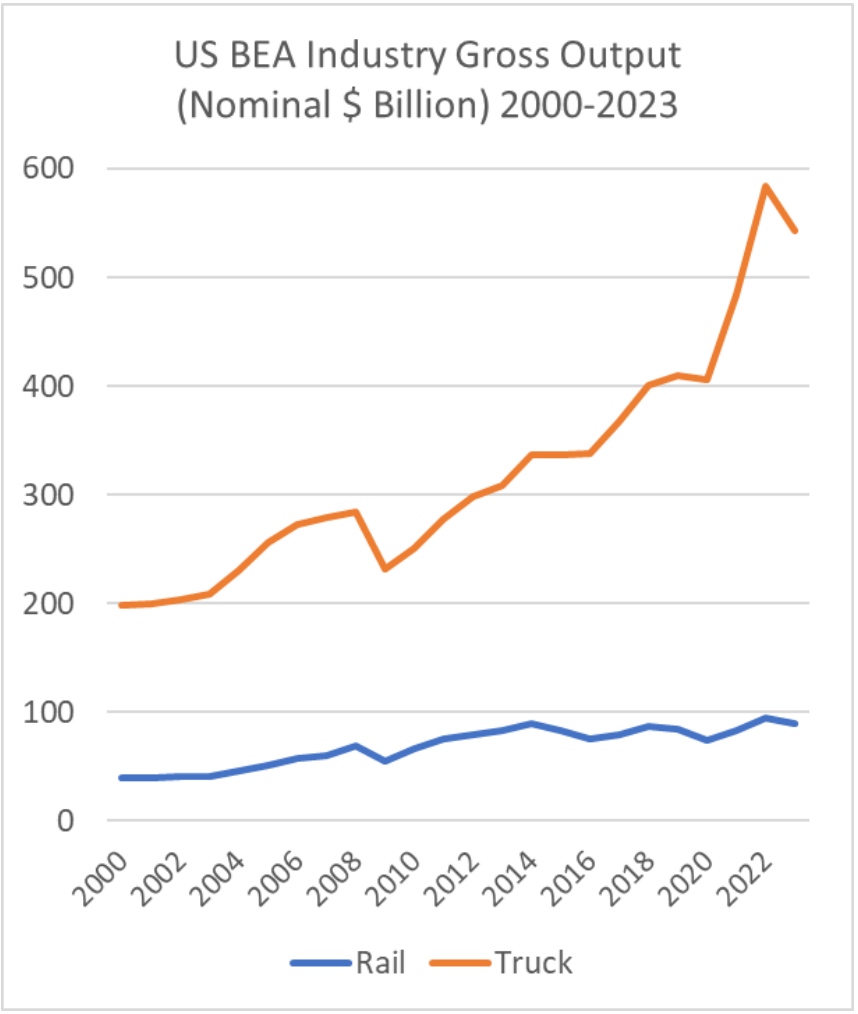
September 17, 2024

Parallel SYSTEMS

Exhibit 1: Gross Output by Industry, 2000-2023

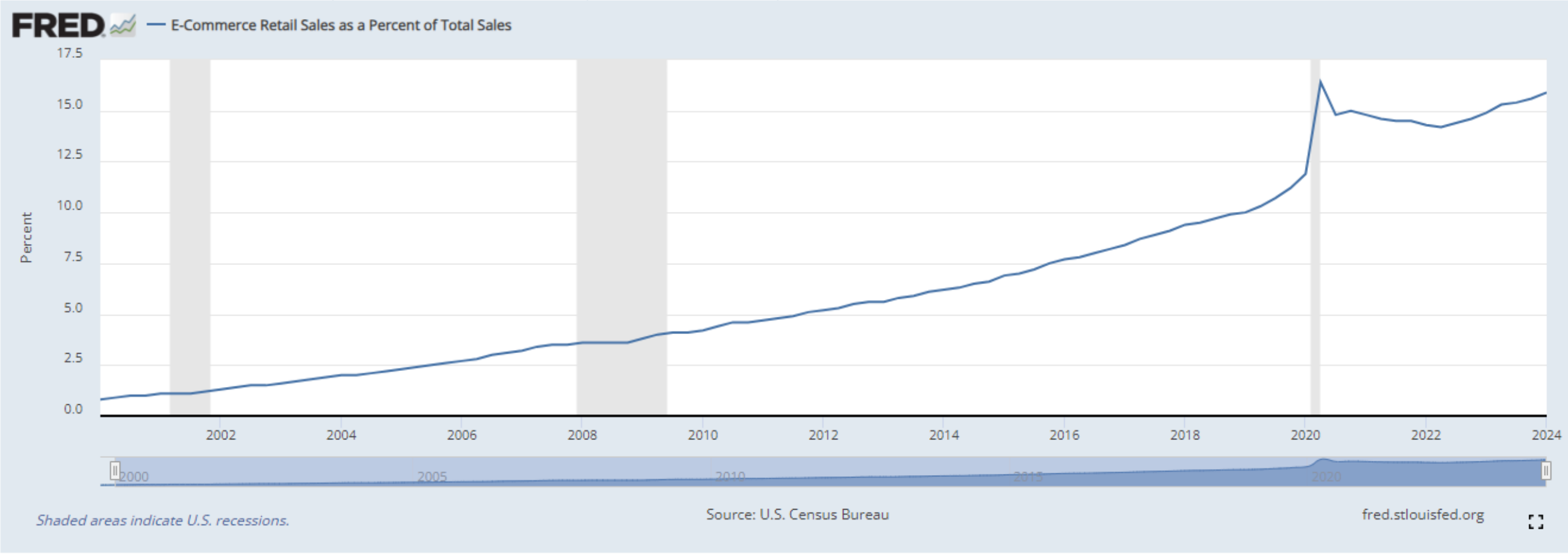






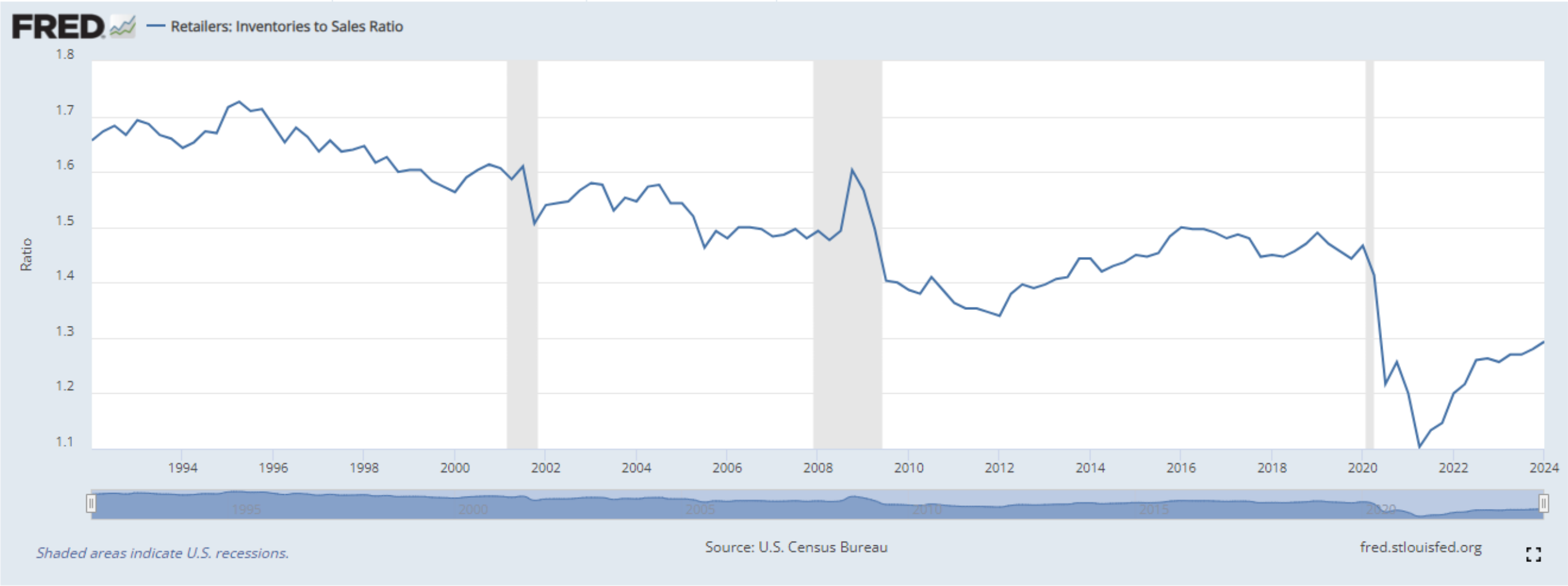
Source: US Bureau of Economic Analysis. https://apps.bea.gov/industry/Release/XLS/GDPxInd/GrossOutput.xlsx

Exhibit 2: E-Commerce as a Percent of Retail Sales, 2000-2024



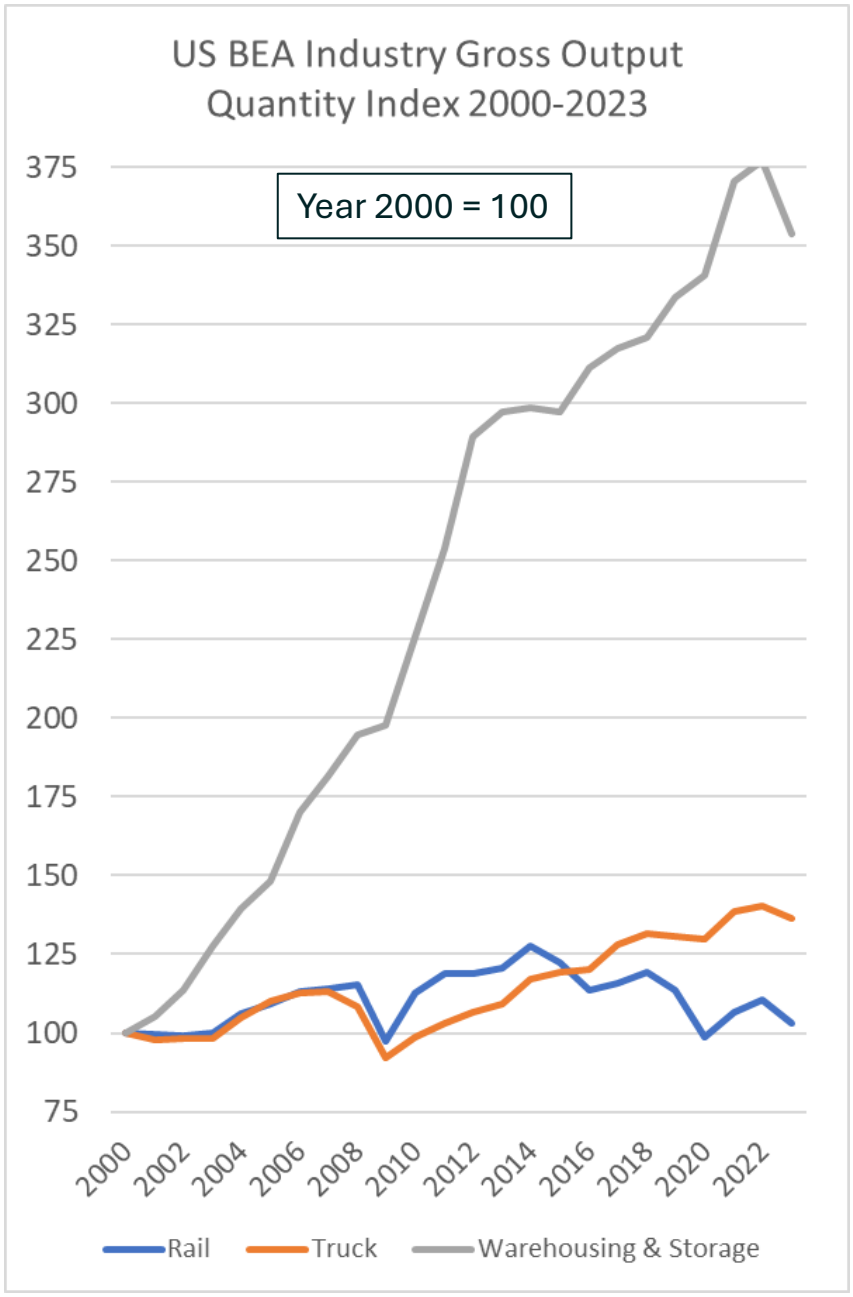
Source: US Census Bureau and Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/ECOMPCTSA

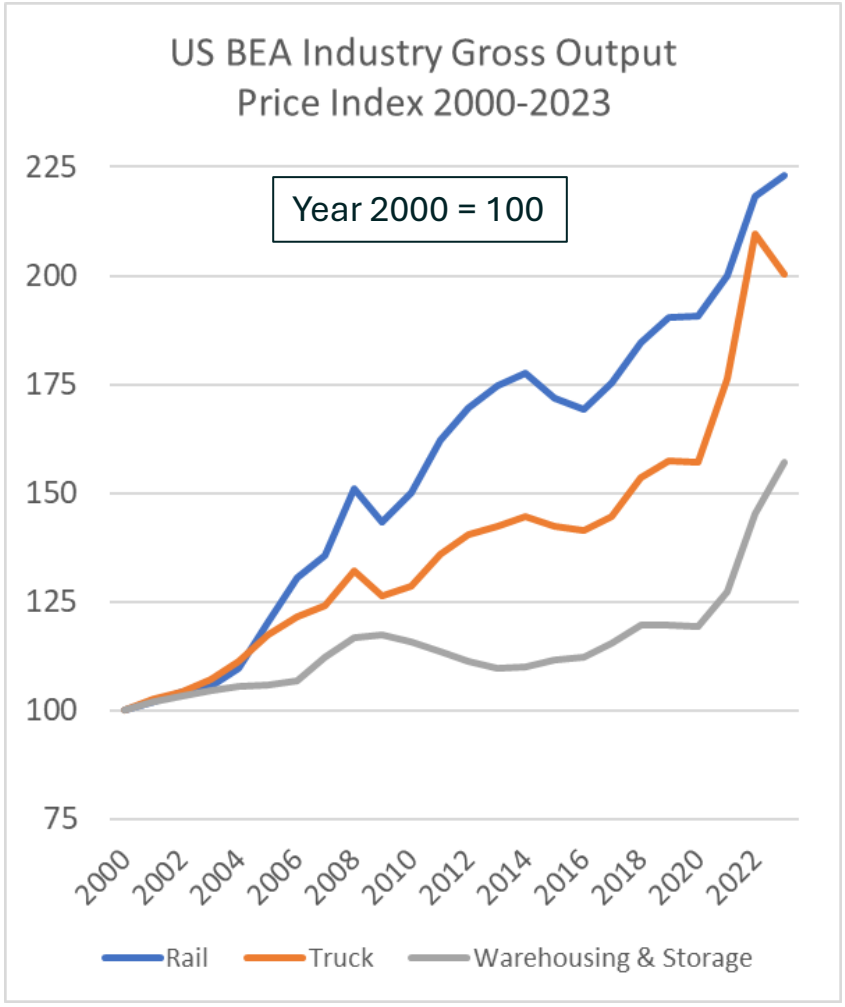
Exhibit 3: Inventory to Sales Ratio, 2000-2024

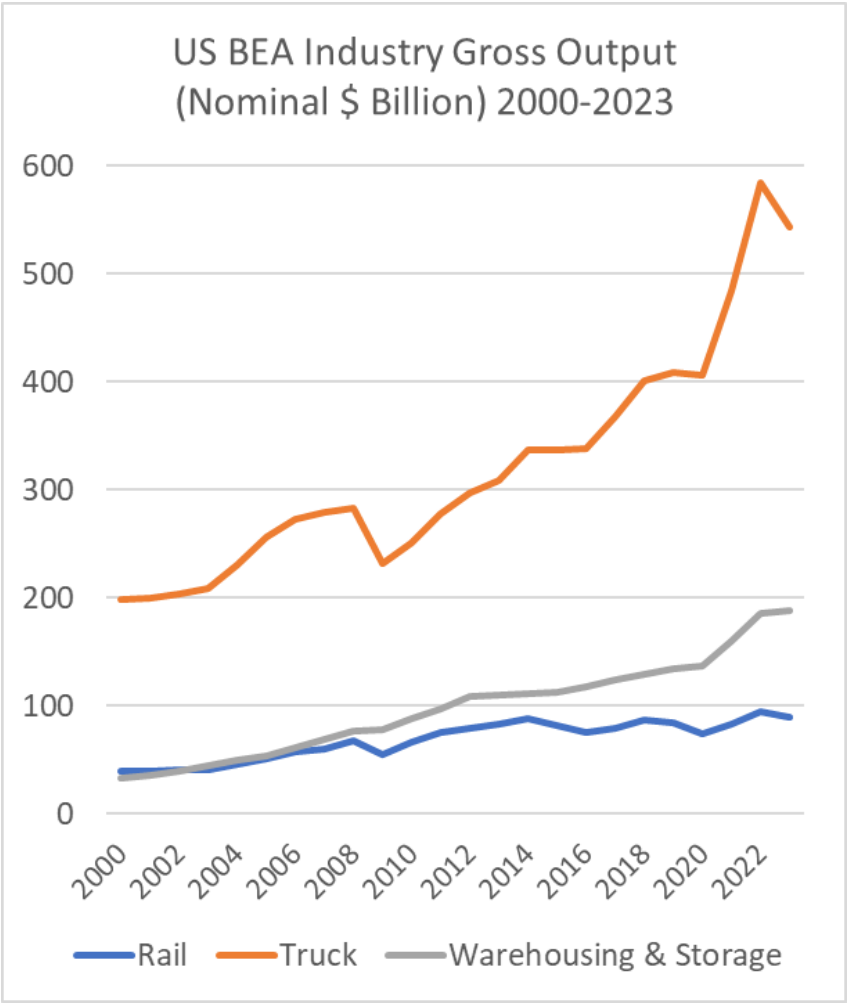


Source: US Census Bureau and Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/RETAILIRSA

Exhibit 4: Gross Output by Industry, 2000-2023 Now Including Warehousing & Storage

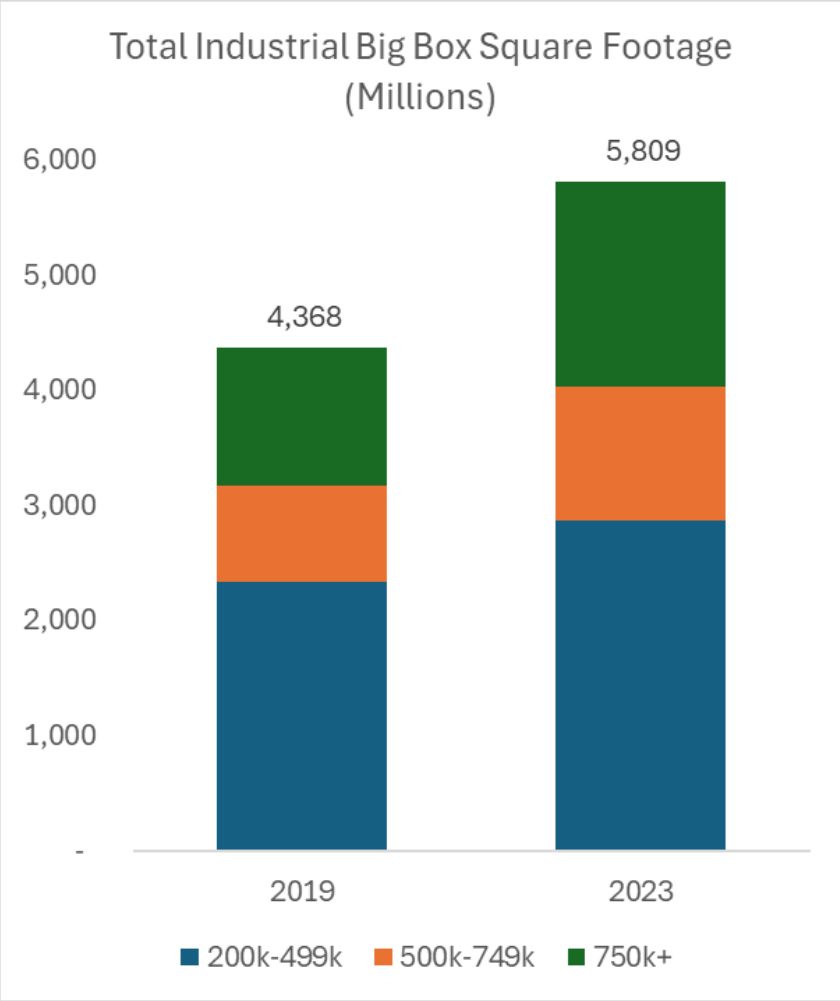


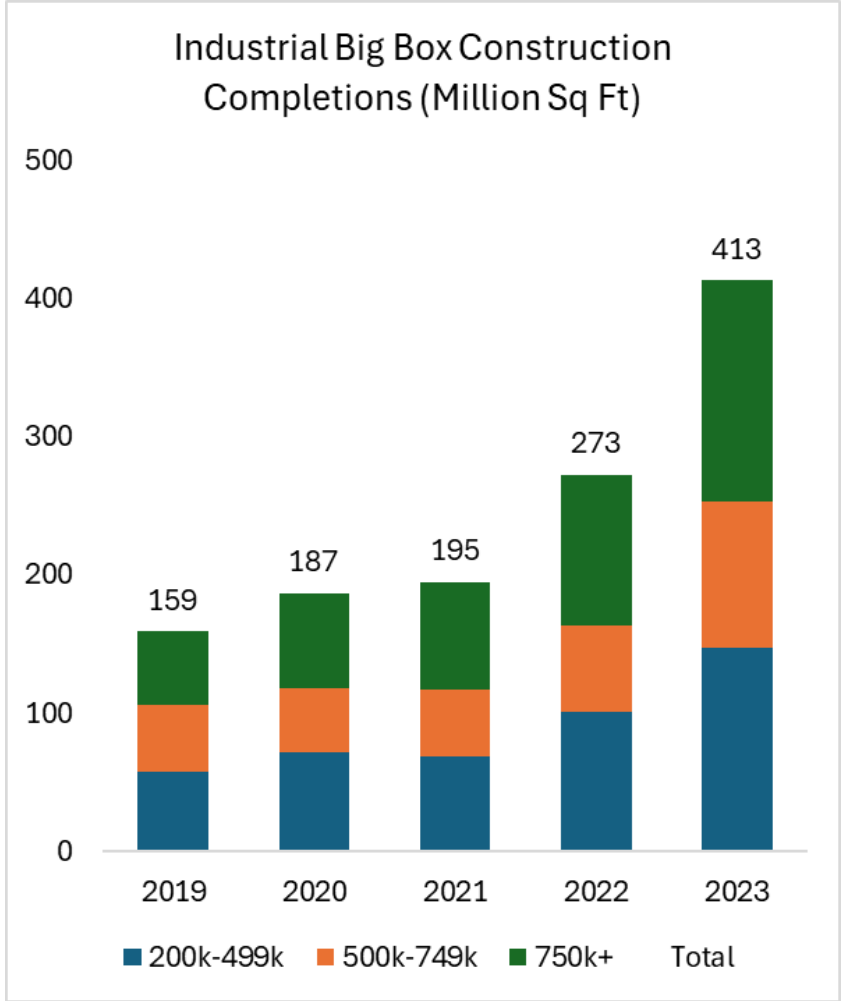


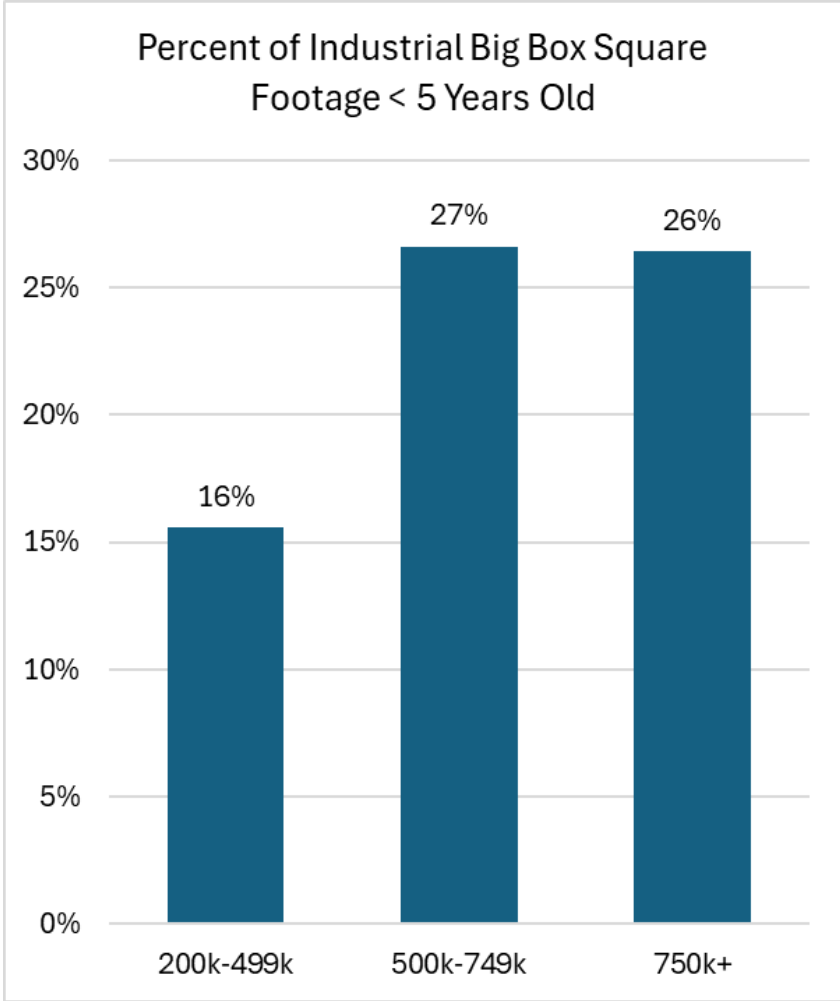


Source: US Bureau of Economic Analysis. https://apps.bea.gov/industry/Release/XLS/GDPxInd/GrossOutput.xlsx

Exhibit 5: Industrial Big Box Growth 2019-2023







Graphs derived from CBRE North American Industrial Big Box Review and Outlook: https://www.cbre.com/insights/reports/2024-north-america-industrial-big-box, https://www.cbre.com/insights/reports/2023-north-america-industrial-big-box, https://www.cbre.com/insights/reports/2022-north-america-industrial-big-box, https://mediaassets.cbre.com/-/media/project/cbre/shared-site/insights/local-responses/2020-industrial-big-box.pdf?rev=1e71b73a903f477daf0607410ca70b67

Exhibit 6: A Characteristic Big Box

Exhibit 7: A Montage of Logistics Campuses

Aberdeen, MD

- Despite the proximity of significant rail routes, only 4 sites out of approximately 50 have direct rail access
- Only one of these meets the Industrial Big Box definition

Exhibit 7, continued

Carlisle, PA

- 6 sites out of 44 have direct rail access

Exhibit 7, continued

Suffolk, VA

- No direct rail access

Exhibit 7, continued

Savannah, GA

- One site out of 53 with direct rail access
- Pre-existing rail removed from NFI site

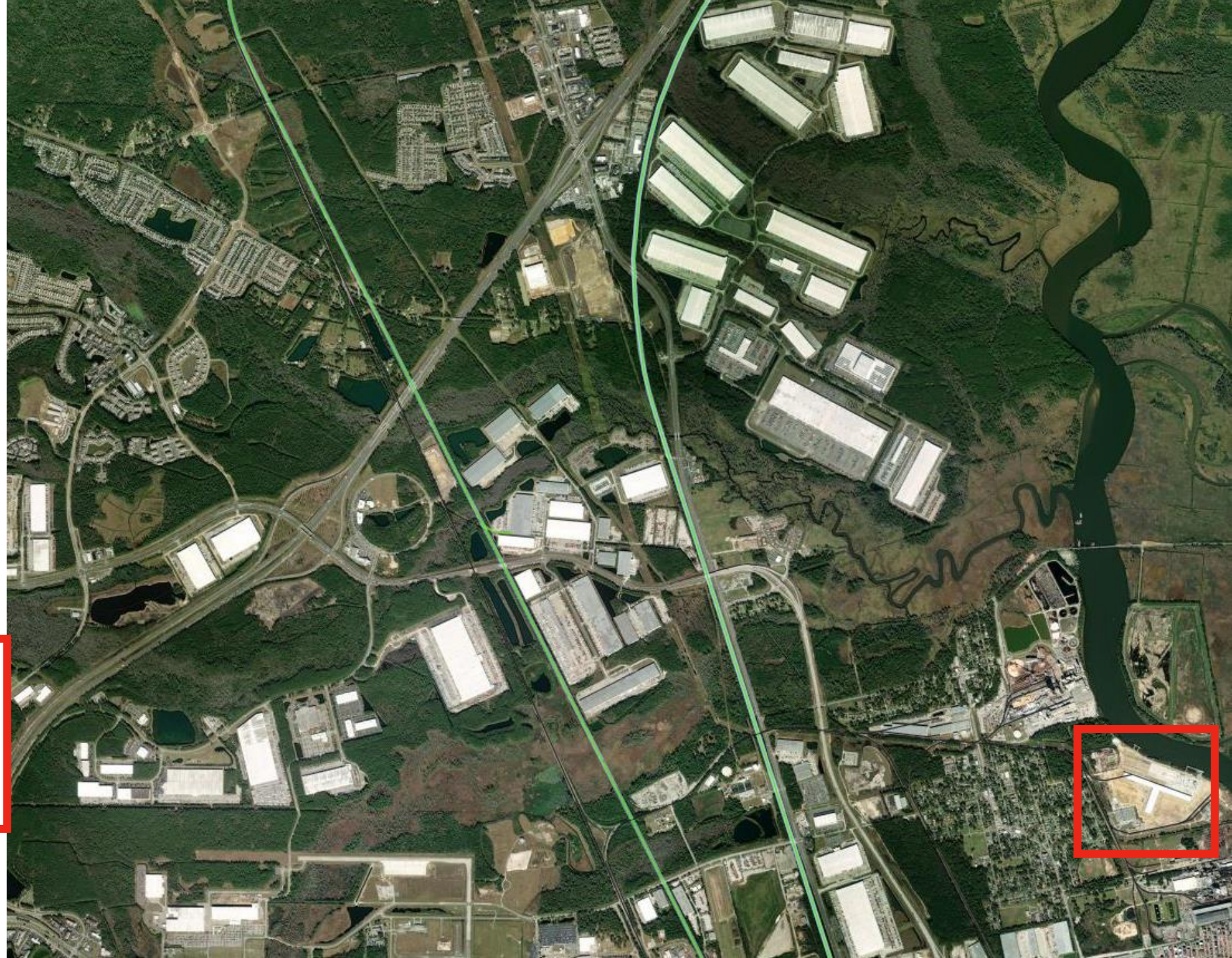


Exhibit 7, continued

Riverside, MO

- Direct rail access to 3 of 40 existing or graded sites

Exhibit 7, continued

Perris, CA

- Direct rail access to 2 of 100+ sites
- Rail removed from Weber Logistics brownfield development
- I-215: Access conduit for trucks… Barrier for rail

Exhibit 7, continued

Sparks, NV

- Campus developing around the Tesla “Gigafactory”
- Industrial spur and serving yard west of NV Route 439
- Majority of big boxes east of Route 439

Exhibit 8: Prototype Vehicle (One of Five)